quiet standing. It is anticipated that the results will be useful in design and training guidelines for FES users.
Methods: Two subjects with SCI were case studies. FES user #1 was 38 years old, had a T6 level injury (ASIA-A), and used an Octostim for surface stimulation of the quadriceps, hamstrings, and gluteals. FES user #2 was 32 years old, had a T4/T5 level injury (ASIA-A), and used an implanted CWRU/VA system to stimulate the gluteus maximus, posterior adductor, vastus lateralis, and erector spinae muscles. FES users stood at parallel bars with minimal hand support. Seventeen subjects (9 male/8 female, age 32.2 ± 5.4 yrs) participated as an able-bodied comparison. Subjects quietly stood for 30 s using normal (ASIS width), wide (twice normal width), and staggered (ASIS width, dominant foot shifted one foot length forward) foot placements. FES users stood twice with each foot placement on four separate days (24 trials), while able-bodied subjects stood three times with each foot placement (9 trials). Each foot was placed on a force platform to measure changes in COP.
Results: FES user #1 averaged 21.1% and FES user #2 averaged 10.5% body weight hand support. Maximum medial/lateral (M/L) COP velocities were higher for FES users with normal (FES#1 72.7, FES#2 116.5, able-bodied 20.5 ± 7.1 mm/s), wide (FES#1 84.1, FES#2 181.6, able-bodied 27.6 ± 8.5 mm/s), and staggered (FES#1 97.0, FES#2 133.7, able-bodied 47.8 ± 17.1 mm/s) placements. Similarly, maximum anterior/posterior (A/P) COP velocities were higher for FES users with normal (FES#1 83.6, FES#2 99.0, able-bodied 34.9 ± 14.9 mm/s), wide (FES#1 78.6, FES#2 88.2, able-bodied 38.4 ± 14.4 mm/s), and staggered (FES#1 72.4, FES#2 126.0, able-bodied 58.4 ± 23.0 mm/s) placements. FES users also averaged more anterior A/P COP origins, more asymmetrical M/L COP origins, and greater M/L COP excursions.
Conclusions: FES users displayed the greatest differences from able-bodied individuals in the M/L direction. One explanation is the focus on stimulating muscles with extensor torques, which act primarily in the A/P direction. In addition, higher COP velocities in both the A/P and M/L directions may be due to postural adjustments via hand support being less sensitive and more abrupt. Of those tested, the staggered placement provided the closest match of COP parameters between FES users and able-bodied individuals.

WP-16

Trailing leg postural strategies during slipping

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Introduction: Same-level falls precipitated by slipping are among the leading causes of disability in the elderly. Legs, trunk and arms all contribute to the complex slip-initiated postural response. While the response of the leading leg, i.e. slipping leg, has been previously described [1], a precise characterization of the trailing leg strategies is lacking and this information is important to understand the human factors contributing to the increased risk of slips/falls in older adults. Thus, the goal of this study is to identify the trailing leg postural strategies during slipping, and to investigate whether these strategies are coordinated with the leading leg response.
Methods: Thirteen older (55-67 years old) and 15 younger (20-33 years old) healthy subjects participated in this gait study. To ensure natural walking, participants were informed that the first few trials would be non-slippery. Two or three dry trials were collected ("baseline"). Then, without the participant's knowledge, a glycerol solution was applied onto the floor and another gait trial was conducted ("unexpected slip"). Full body motion and bilateral ground reaction forces were collected. A custom-developed 15 segment whole body model was utilized to derive joint angles and moments using inverse dynamics approaches.
Results: Four strategies termed minimum (MIN), foot-flat (FF), mid-flight (MID), and toe-down (TD) were identified based on the trailing foot flight distance/duration and the trailing foot orientation upon contact with the floor. MIN patterns are the least severe slips and TD responses are the most severe slips ($p = 0.01$). A statistically significant correlation was found between the type of trailing leg strategy and the moment generated by the knee of the leading leg during slipping ($p < 0.01$). Specifically, a reduced extension moment at the knee of the leading leg during slipping appears to be correlated with a greater risk of responding with a TD pattern. Also, subjects who normally (known dry environments) walk with a reduced extension hip moment in the stance leg at contralateral toe off experienced a toe down slip pattern when the floor was contaminated ($p < 0.01$). Finally, age group effects were not statistically significant.
Conclusions: Thus, trailing leg strategies appear to play an important role in slip-initiated recovery responses. The findings of this study suggest the selection of trailing leg strategies depend both on the response generated by the leading leg after a slip is initiated but also on typical normal walking patterns on dry floors. No age effects were found in this study, perhaps because the older group of participants was healthy and not very old. However, the results also suggest that motor responses that may be affected by aging, e.g. walking with a reduced knee/hip extension moment, may aggravate the risk of experiencing a TD slip pattern (most severe slip). —References [1] Cham R, Redfern MS; J Biomech 34:1439-45, 2001. —Funding source: NIOSH R03 OH007533 & R01 OH007592.

WP-17

Expression of emotion changes gait kinematics

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Introduction: Emotion is expressed through multiple physiological channels including voice, facial expression, body movements, autonomic responses and subjective experience. A biological basis for bodily expression is suggested by cross-cultural studies in which emotion is recognized in body movements (Hejmadi 2000). Typically, the effects of emotion on body movement have been studied in actors portraying emotions, and the emotion-related effects have been described only qualitatively, e.g., "heavy-footed" for angry gait (Montepare, 1987). The purpose of this study was to quantitatively describe the effect of felt emotions on gait kinematics.
Methods: Seventeen undergraduates (11 female, 6 male; 18-28 yrs) recalled an experience from their own lives in which they

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)