

The Foot and Ankle Special Interest Group (FASIG) receives inquiries throughout the year from various groups ranging from journalists to industry representatives to provide input on foot and ankle related topics. A recent inquiry questioned the impact of foot and ankle function on mediating fall risk for older adults. This is an interesting question and has a growing focus from government related agencies, industry, and the scientific community. Many clinicians can likely concur that complaints of foot pain are common in our older patients and may be associated with impaired balance and falls.

Perhaps a place to start is the Center for Disease Control and Prevention (CDC) program called Stopping Elderly Accidents, Deaths, and Injuries (STEADI) ([www.cdc.gov/steady/](http://www.cdc.gov/steady/)). In fact, the program logo includes a footprint perhaps underscoring the relevance this might have. In the STEADI risk factor document, gait and balance problems and muscle weakness are listed as intrinsic risk factors but not specific to the foot and ankle. However, foot and ankle disorders are specifically listed as having effective clinical interventions to modify fall risk. Next, in the brochure outlining what you can do to prevent falls there are 4 steps: (1) talk with your health care provider about fall risk and prevention, (2) exercise to improve your balance and strength, (3) have your eyes and feet checked, and (4) make your home safer. From this it seems that the STEADI guideline does seem to identify and promote screening for foot problems and intervening with referrals to a foot specialist.

These guidelines and public advocacy documents are supported with literature that reports changes in tissue biomechanics, age-related changes in joint range of motion, strength, and dynamic foot function. Aging has been shown to cause changes in the heel pad including greater stiffness, dissipation of more energy, and reduced recovery of height after a load has been removed.<sup>1,2</sup> It has been hypothesized that these changes may lead to symptoms in the older foot while younger feet can withstand loading thousands of times a day without pain. Studies have shown that ankle and subtalar motion may be reduced by 12% to 30% in older people and more recently older people were found to have 32% less dorsiflexion range of motion at the first metatarsophalangeal joint than younger people.<sup>3-5</sup> One of the most characteristic features of aging is reduced muscle mass with reports between 20% and 40% loss in individuals between the ages of 30 and 80 years.<sup>6</sup> Muscle weakness tends to be in the lower extremities more than the upper extremities and progresses from distal to proximal making the feet and ankle particularly susceptible to atrophy.<sup>7</sup> Loss of strength may be associated with difficulties rising onto the toes, and toe weakness may impair the grasping functions of the toes to aid in balance. Also, atrophy of toe muscle may play a role in the development of toe deformities. However, emerging evidence indicates that age-related reductions in foot and ankle range of motion and strength may be at least partly ameliorated by targeted foot and ankle exercise programs in older people.<sup>8</sup>

Evidence of a lower medial longitudinal arch in older individuals may also have implications for dynamic foot function. Data across 619 people show higher values on the foot posture index (FPI) indicating a more pronated foot and lower arch as individuals age.<sup>9</sup> Coupled with a lower arch structure kinematic studies have

shown an increase in midfoot and metatarsal stiffness. Together with a plantar flexed calcaneus these changes are consistent with a reduction in foot function for pushing off while walking in older adults.<sup>10</sup> Using a pull-off hip strategy in favor of a push-off ankle strategy may be a function of aging consistent with changes seen in the distal lower extremity including loss of range of motion and weakness.<sup>11</sup> In a recent study of 80 older adults over the age of 75, the presence of a lower arch in males was associated with measures of postural deterioration explaining up to 30% of variance.<sup>12</sup>

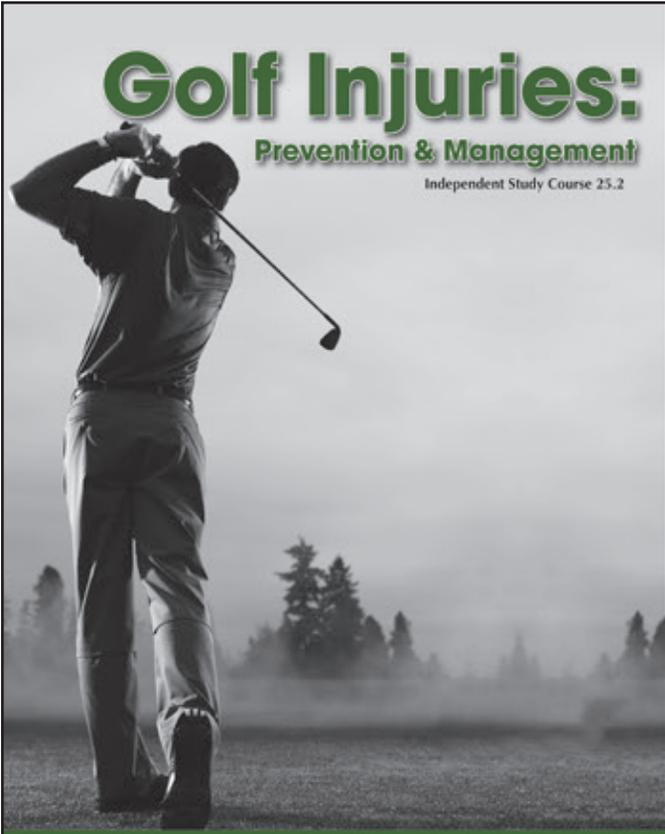
Age-related changes in foot structure and mechanics is linked to postural instability but these changes may be further exacerbated in the presence of certain diseases. Most clearly the evidence for diabetes and foot-related changes in structure and sensation have been linked to falls. The prospective study by Richardson et al<sup>13</sup> suggests that loss of ankle proprioception is the greatest predictor of falls when coupled with hip weakness in subjects with diabetes. Other conditions that cause foot deformity such as hallux valgus, tibialis posterior tendinopathy leading to flatfoot, or ankle arthritis have also been associated with balance impairment.

Physical therapists, as well as other medical professionals, who commonly treat foot-related pain and dysfunction are likely to see patients with impaired balance and perhaps a history of falls that can be addressed through management of the foot and ankle problems. The CDC and other groups are encouraging the use of medical professionals that can address foot and ankle-related pain and dysfunction to minimize falls. Physical therapists may be well positioned to manage these patients using a range of intervention strategies to address vision, vestibular, proprioceptive, and other specific foot and ankle related pathologies. Patient education on “foot checks” and good footwear are encouraged. Additionally, some evidence suggests improved balance with custom ankle foot orthoses are thought to provide additional mechanical and proprioceptive stability to the ankle and foot.<sup>14</sup> Ankle orthoses are commonly used for select patient populations but there is some evidence they may benefit many aging adults to improve their balance.

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