

[博士論文概要]

Foot characteristics and its association with balance in older adults

(高齢者における足部の特性とバランス能力との関係性)

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Population ageing is widespread across the world and it is more in the most highly developed countries such as Japan. With aging, balance ability is widely acknowledged to decline. Maintenance of balance depends on the interaction of multiple sensory motor and integrative systems. Function of these systems declines with age and can lead to fall. Such fall incidents require medical attention and making individuals grapple with pain and suffering as well as placing a financial burden on patients, their family and society. All these reasons indicate that we are in dire need of protective measures in all social, economic, cultural aspects and also health care.

Most falls occur while an individual is in motion. During normal gait, the foot is the only source of direct contact with the ground. Therefore, the foot plays a considerable role in maintaining balance and stability during movement. Despite this, little is known about foot characteristics and its association with balance in older adults. Therefore, the primary aim of this thesis was to determine whether foot characteristics, which were foot deformity and static foot posture, associate with balance in independently-living older adults. As the foot and toes play crucial role in safe and efficient movement, it was hypothesised that foot deformity would be associated with poor balance. Furthermore, the association between balance and static foot posture, which in this study was arch height calculated using two different ways of measurements, was investigated. The secondary aim was identify gender differences in foot characteristics to design comfortable and efficient shoes in Japan which has large elderly population.

A total of 349 older adults participated in this study conducted in the Kasama City health center. Of these participants, we excluded some due to incomplete data, their reliance on walking sticks during the measurement or among women because of refusing to remove their pantyhose preventing us from collecting foot characteristic and balance or postural sway data. We assessed foot characteristics, using

the recently launched 3D foot scanner by Dream GP Company, Japan. Balance tests and body mass index (BMI) of participants were measured and medical histories were gathered via face-to-face interviews.

There is significant positive correlation between the first toe angle and poor balance especially in women. Therefore, the first toe angle is an important determinant of balance in community-dwelling older people.

Furthermore, our study provides intriguing findings on the associations between sitting arch height index (AHI) and balance in both genders. Arch rigidity index (ARI) is associated with postural sway and static balance in women and men, respectively. Moreover, sitting navicular height (NH) and foot mobility are associated with postural sway in women and with balance in men. These findings suggested that among all those methods, sitting AHI might be better method for defining balance control in older adults.

In addition, the current study shows evidence of difference between some of the foot characteristics and shapes of older men and women. Gender differences in older adult's foot shape should be considered when manufacturing shoes for them.