TITLE: Identify Fall-Specific Somatosensory Thresholds (FaSST) for Improving STEADI Fall Risk Screening Algorithm – Preliminary Data Analysis

SECTION: Geriatric- Balance and Fall

Presentation Type: Poster

AUTHORS/INSTITUTIONS:
Ashley Skutka, SPT[1], Riley Horn[2], Summer Kenny[3], Emma Blount[3], Stacey Meardon, PhD, PT[1], Kevin O'Brien[4], Chia-Cheng Lin, PhD, PT[1]

[1]Department of Physical Therapy, College of Allied Health Science, East Carolina University NC, USA
[2]Department of Kinesiology, College of Health and Human Performance, East Carolina University, NC, USA
[3]Honors College, East Carolina University, NC, USA
[4]Department of Biostatics, College of Allied Health Science, East Carolina University, NC, USA

ABSTRACT BODY:
Purpose/Hypothesis: The Stopping Elderly Accidents, Deaths & Injuries (STEADI) has been promoted by the CDC to prevent falls in older adults. Somatosensory input from the foot plays a critical role in postural control and is commonly screened by primary care providers. However, the STEADI fall risk screening algorithm does not include sensory screening. The purpose of this study was to identify specific sensory cutoff values for pressure sensation (PST) and vibration perception threshold (VPT) associated with abnormal static and dynamic balance performance to complement STEADI screening.

Number of Subjects: One hundred and twelve participants

Materials/Methods: A set of monofilaments and hand-held bio-thesiometer were used to measure PST and VPT, respectively. PST and VPT were measured at 6 sites bilaterally (big toe, 1st metatarsal, 5th metatarsal, medial arch, and calcaneus) and averaged for each foot and across both feet. The dynamic gait index (DGI) and Sensory Organization Test (SOT) were used to assess dynamic and static balance performance. A DGI score < 19 and SOT composite score less than age-matched controls were considered abnormal findings. Receiver Operating Characteristic (ROC) curves were used to identify cutoff values for PST and VPT associated with abnormal

dynamic and static balance as well as the associated sensitivity (sn), specificity (sp), and the area under the curve (ROC_A) ($\alpha < 0.05$).

Results: Results indicated that 5 subjects displayed abnormal DGI scores and 37 subjects displayed abnormal SOT results. ROC analysis suggested that PST cutoff values to predict abnormal DGI scores were ~0.4g for right foot (sn=100%, sp=74%, ROC_A=0.94, p<0.01), ~0.6g for left foot (sn=100%, sp=88%, ROC_A=0.95, p<0.01), and ~0.5g for the averaged PST (sn=100%, sp=80%, ROC_A=0.95, p<0.01). The VPT cutoff values for abnormal DGI were 11.53 volts (v) for right foot (sn=100%, sp=85%, ROC_A=0.92, p < 0.01), 11.10 v for left foot (sn=100%, sp=84%, ROC_A=0.92, p<0.01), and 11.53 v for the averaged PST (100% sensitivity, 84% specificity, ROC_A = 0.93, p<0.01). The PST cutoff values to predict abnormal SOT values were ~0.3g for right foot (sn=62%, sp=64%, ROC_A=0.65, p<0.05), ~0.3g for left foot (sn=65%, sp=55%, ROC_A=0.64, p<0.05), and ~0.3g for the averaged PST (sn=65%, sp=59%, ROC_A=0.65, p<0.01). The VPT cutoff values for abnormal SOT values were 6.42 v for right foot (sn=62%, sp=63%, ROC_A=0.63, p<0.05), 6.21 volts for left foot (sn=62%, sp=63%, ROC_A=0.63, p<0.05), and 6.42 v for the averaged VPT (sn=60%, sp=63%, ROC_A=0.63, p<0.05).

Conclusions: These results suggest that diminished plantar pressure and vibration sensation were associated with both impaired dynamic and static balance. PST and VPT cutoff values differentiating those with and without abnormal postural control approximated the 0.4g and 6.2-11.5 v.

Clinical Relevance: The STEADI fall risk screening algorithm has been promoted in the primary care setting. Incorporating screening for diminished sensation along with the STEADI screening fall risk algorithm may improve early identification of elderly with potential fall risk and prompt referral to physical therapy.

Keywords: protective sensation, vibration, balance, fall risk

1-6.

1. Cavanagh, P.R., Rodgers, M.M., and Iiboshi, A., P*ressure Distribution under Symptom-Free Feet during Barefoot Standing.* Foot & Ankle, 1987. 7(5): p. 267-274.

2. Njafi, B., Crews, R.T., and Wrobel, J.S., *A novel plantar stimulation technology for improving protective sensation and postural control in patient with diabetic peripheral neuropathy: a double-blinded, randomized study.* Gerontology, 2013. 59(5): p. 473-480.

3. Carvalho, V.F., Ferreira, M.C., Vieira, S.A., and Ueda, T., *Cutaneous sensibility threshold in the feet of diabetic patient with pressure sensory device: an assessment of the neuropathy.* Revista da Associação Médica Brasileira, 2009. 55(1); p: 29-34.

4. Adams, O.P., Herbert, J.R., Howitt, C., and Unwin, N., *The prevalence of peripheral neuropathy severe enough to cause a loss of protective sensation in a population-based sample of people with known and newly detected diabetes in Barbados: a cross-sectional study.* Diabetic Medicine, 2019. Epub ahead of print.

5. Allison, L.K., Kiemel, T., and Jeka, J.J., *Sensory-Challenge Balance Exercises Improve Multisensory Reweighing in Fall-Prone Older Adults.* Journal of Neurological Physical Therapy, 2018. 42(2); p. 84-93.

6. Nithman R.W. and Vincenzo J.L. *How steady is the STEADI? Inferential analysis of the CDC fall risk toolkit.* Arch Gerontol Geriatr. 2019. 83:185-194.