



# Validity of the paper pull test for strength in patients with hallux valgus

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## BACKGROUND

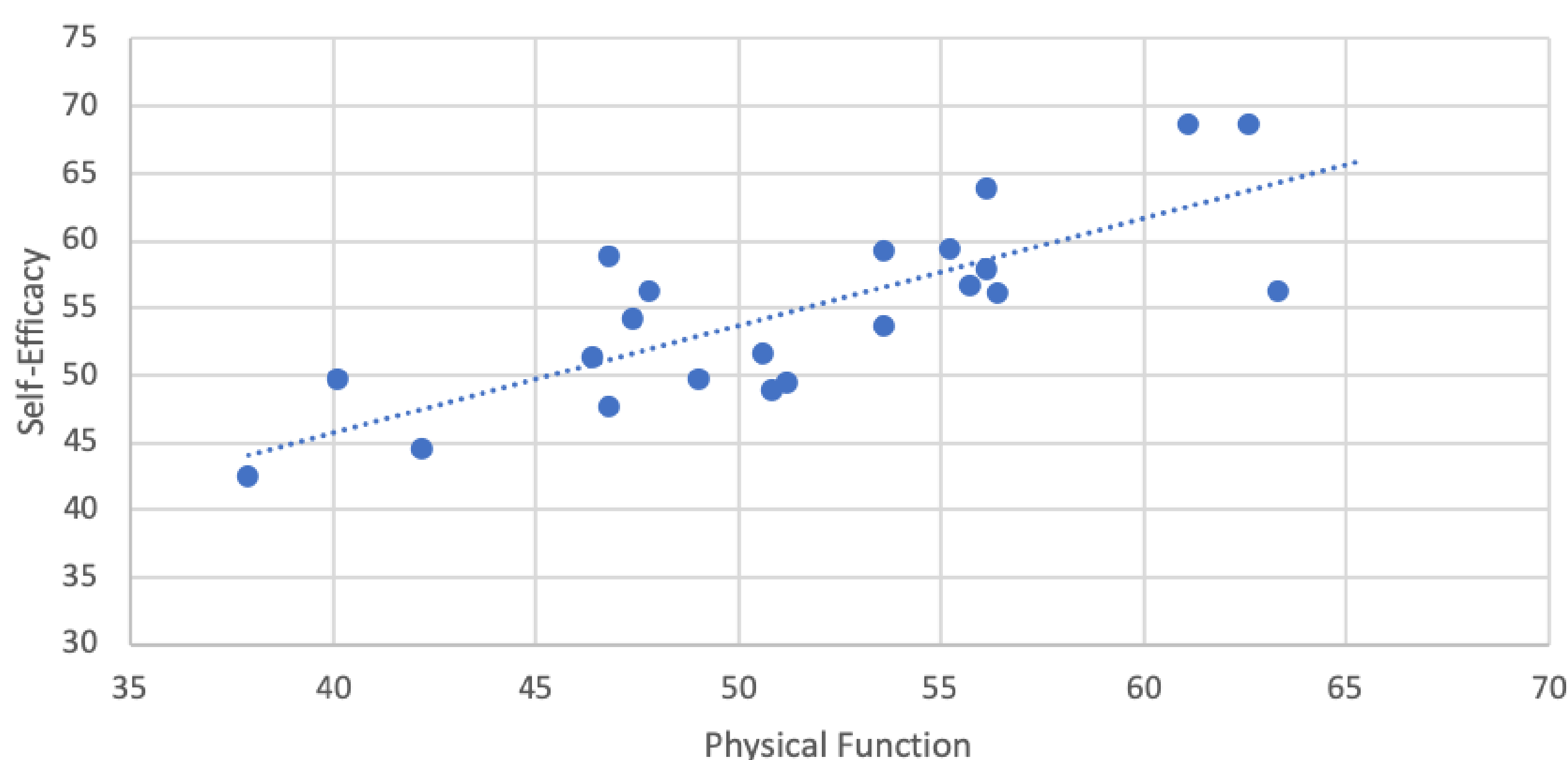
Hallux valgus (HV) is a progressive deformity affecting the foot and big toe and it most commonly affects middle to older aged females. This study explores the validity of the paper pull test to assess the strength and function and utilizes PROMIS scores to assess the relationship between biological and psychosocial factors in patients with HV.

## PROMIS®

PROMIS® is person-centered measures that evaluate and monitor physical, mental, and social health. (source: HealthMeasures.net)

- ✓ PROMIS® Physical Function (PF) scores correlated with great toe max force ( $r(22) = .525, p = 0.012$ )
- ✓ The correlation of Self Efficacy (SE) with PF ( $\rho=0.71, p<0.01$ ) and Pain Interference (PI) ( $\rho=-0.75, p<0.01$ ) were classified as excellent

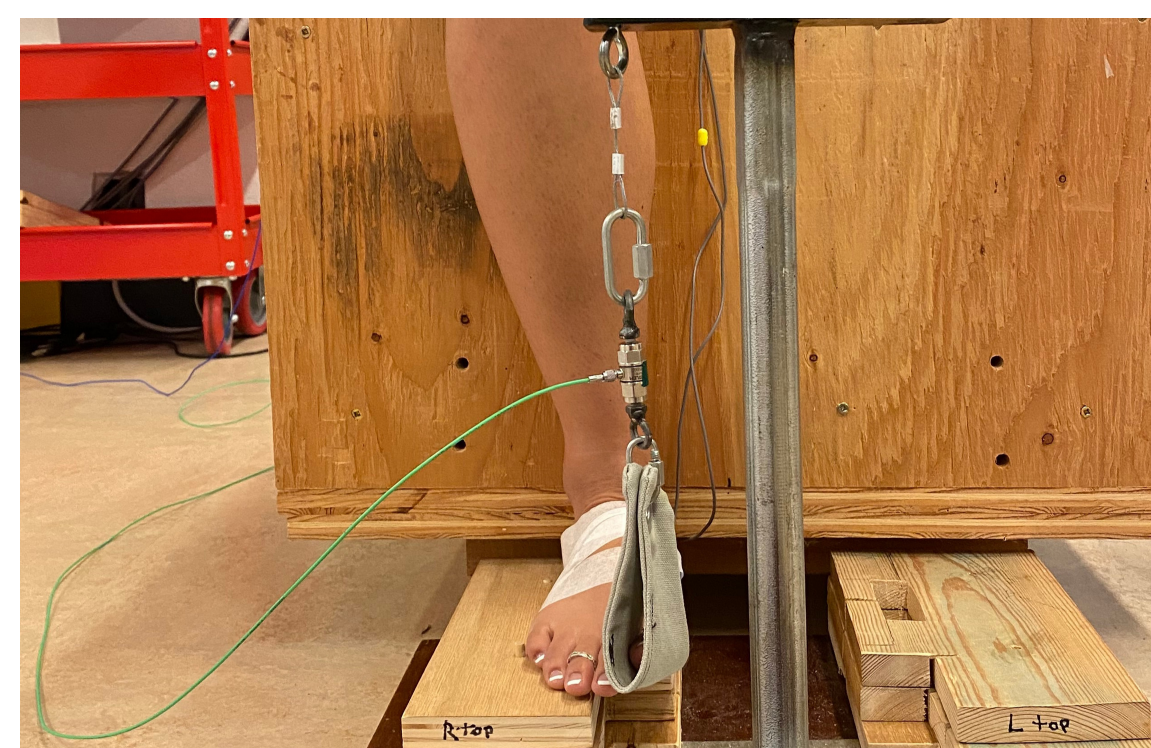
Physical Function versus Self-Efficacy in Patients with HV



## TESTS

### GT FLEXION STRENGTH

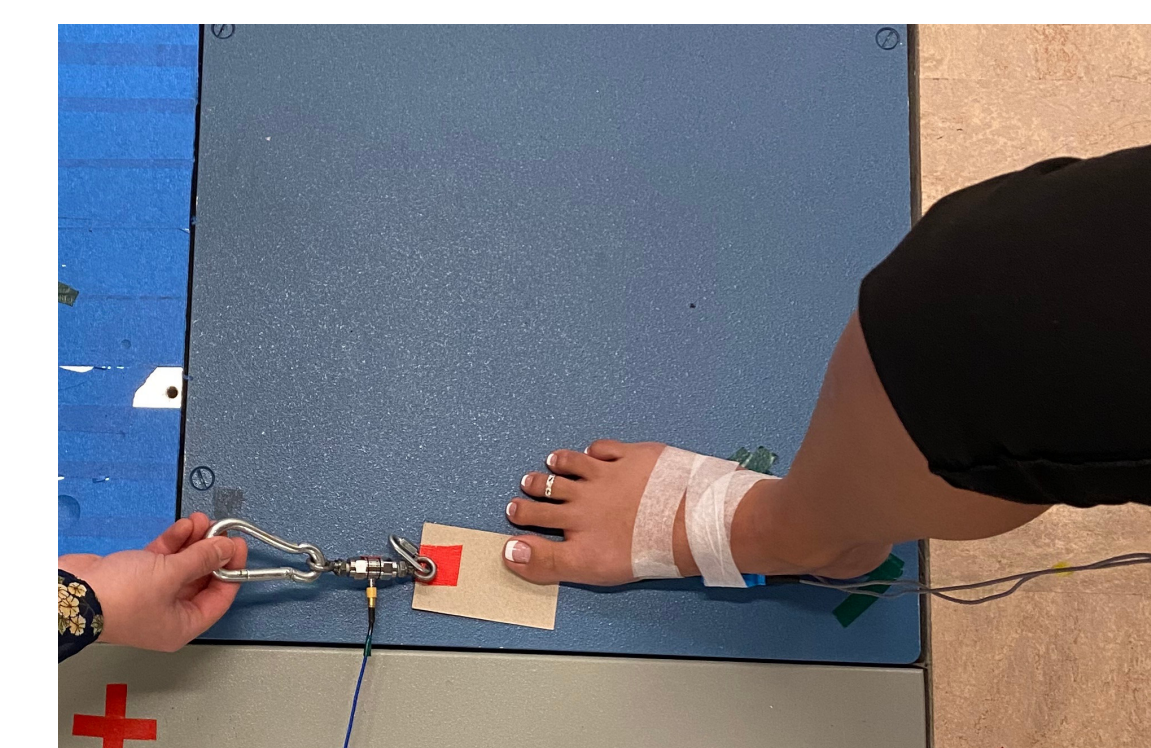
A custom force transducer (Kistler 9311B) was integrated into a special jig to assess max great toe (GT) flexion in sitting.



✓ Max GT force correlated highly with PPT force ( $r = 0.87, P<0.01$ )

### PAPER PULL TEST

The same transducer was connected to a wire through an eyelet in cardstock to measure max force during PPT



✓ The PPT is an effective evaluation of 1st MTP flexion strength in patients with HV.

### HEEL RISE TASK

A 3-D movement analysis system measured heel height and divided the HR into an up (HR-Up) and down (HR-Dwn) phase.

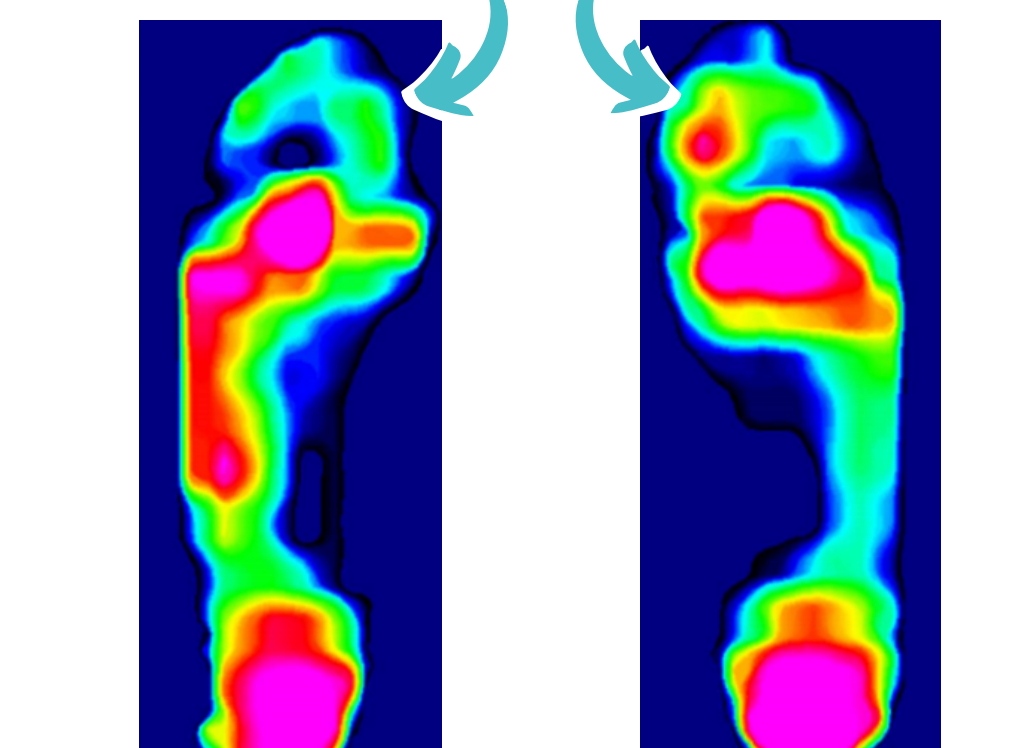


✓ Strength somewhat correlated with HR height ( $r = -0.41, P<0.01$ ).

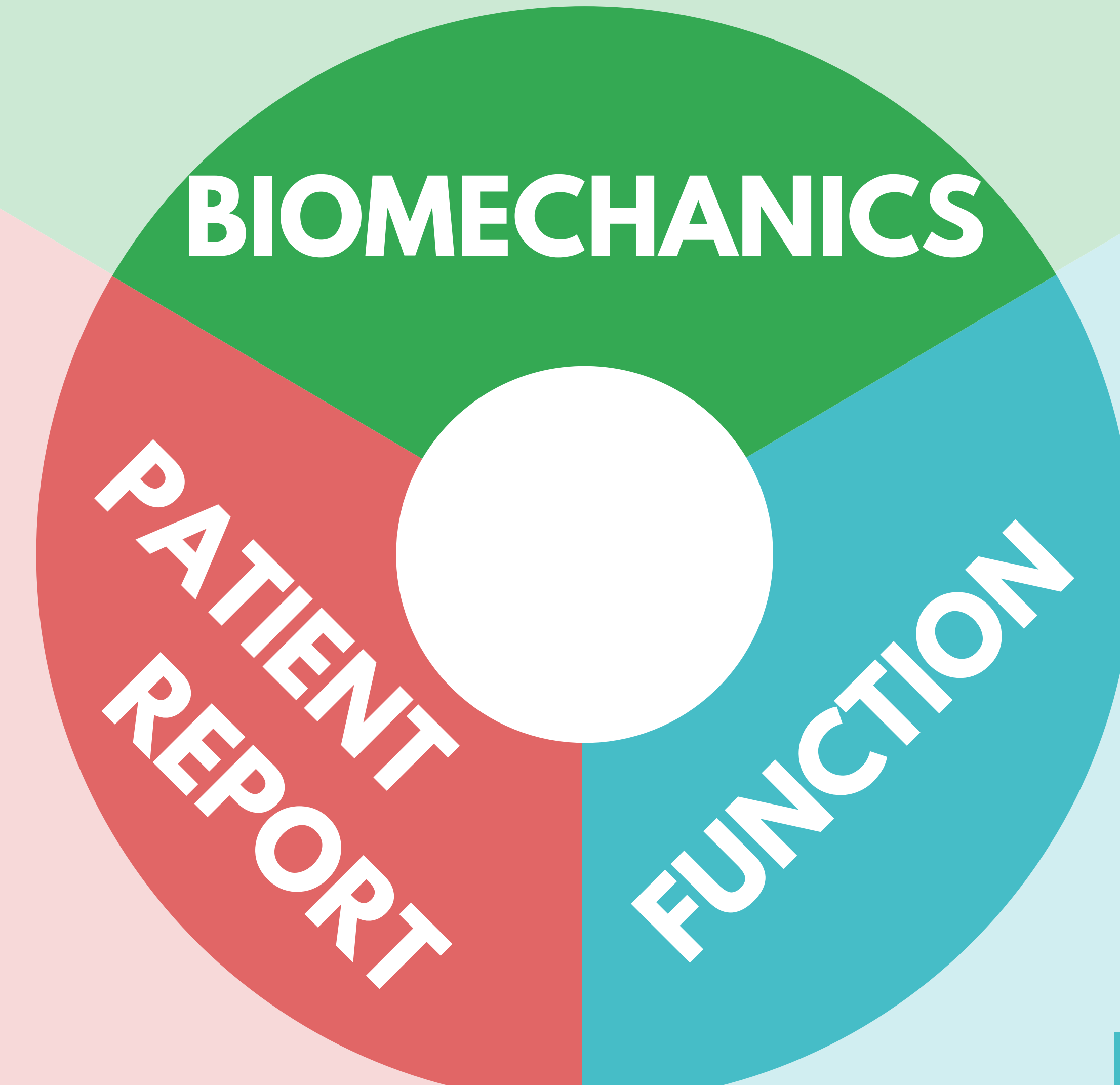
### PEDAR® FOOT PRESSURE

Mapped forces during barefoot gait

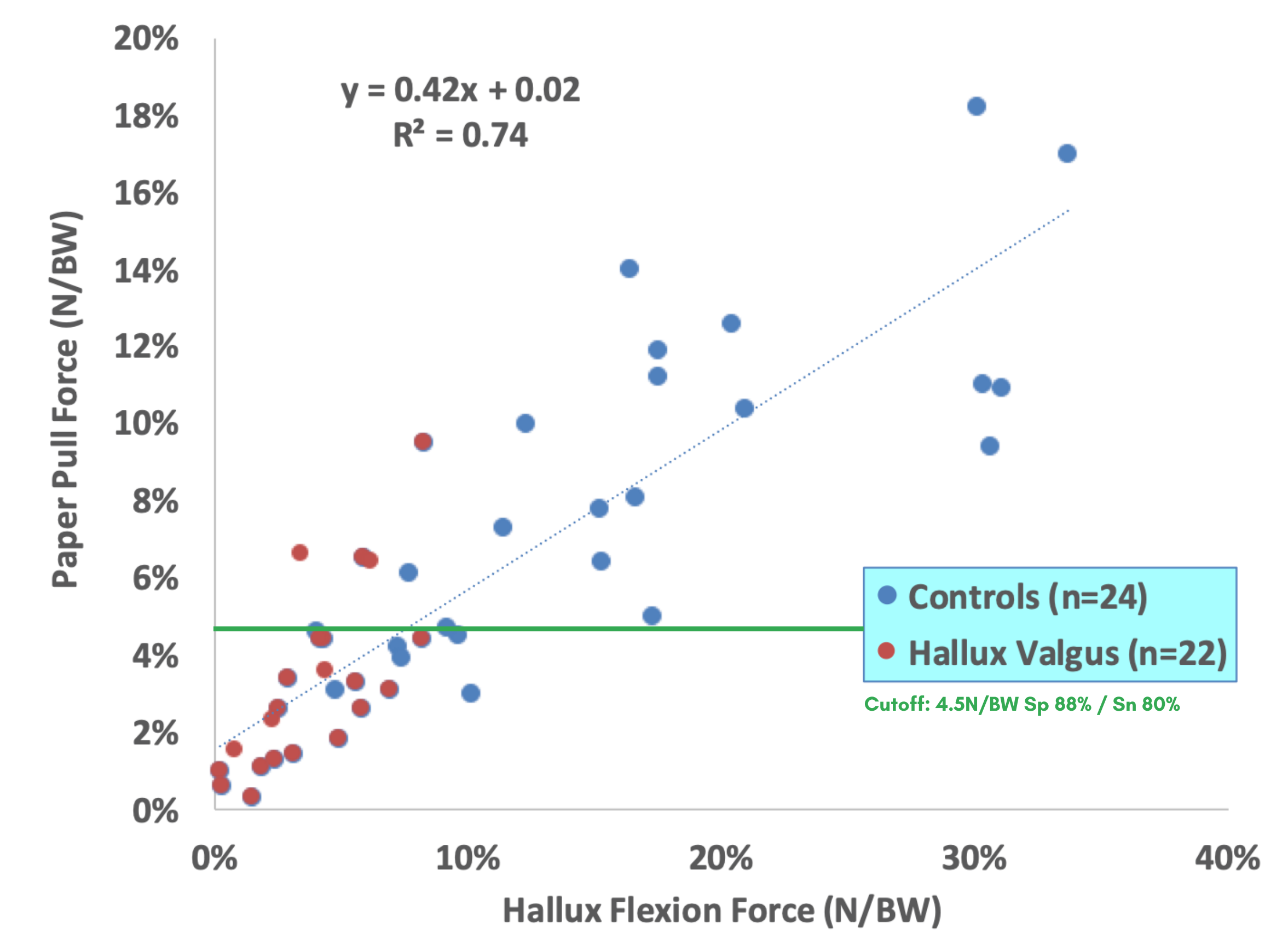
Manchester D 0.17% BW      Manchester A 0.28% BW



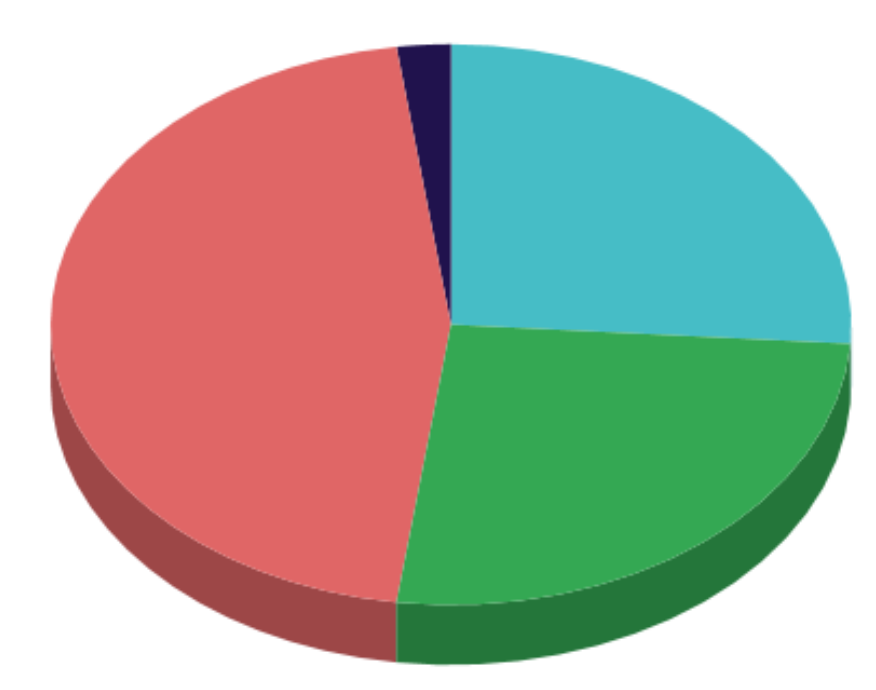
✓ Great toe force during gait (%BW) correlated to HR height (cm) ( $r=0.59$ )



## RESULTS



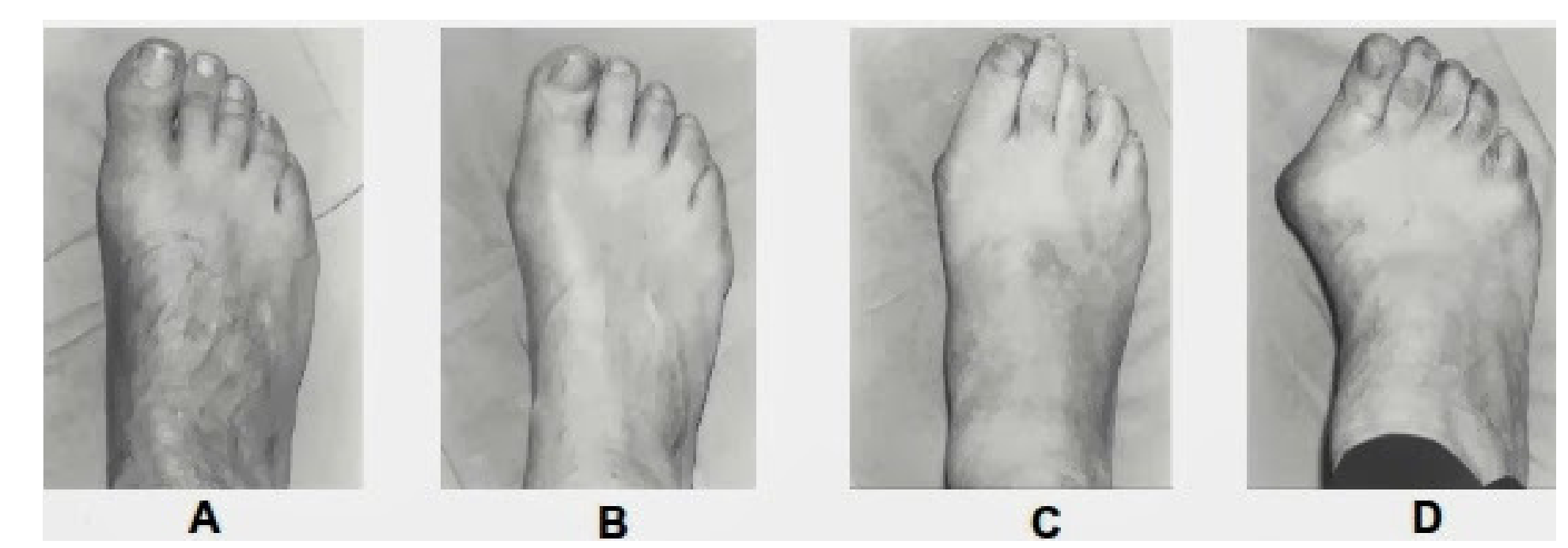
## THE PEOPLE



- Control, Female (12)
- Control, Male (12)
- HV, Female (21)
- HV, Male (1)

Age: Control: 20-62 years; HV: 19-76 years

Manchester Scale, HV: A:0 B:7 C:9 D:6



## CLINICAL RELEVANCE

- ✓ The correlation between the PPT and heel rise height suggests that patients with these deficits may benefit from foot intrinsic strengthening.
- ✓ The significant weakness seen in patients with HV (surgery or not) may suggest that they avoid loading the great toe during gait and HR tasks.
- ✓ In foot and ankle studies, psychosocial outcomes are less emphasized than more routine biologic outcomes (i.e. PF and PI). The correlation between SE (a psychosocial variable) with PF and PI in patients with HV demonstrates their clinical importance.

We would like to extend a special thanks to Robin Dorociak for her tireless contributions during data collection and processing, and her contagious positivity throughout.

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