



University of
Strathclyde
Engineering

The Importance of the Supination Resistance Test (SRT)

Agyepong Eugene Opare

Supervisor: Chris Cox

Stakeholder Day, 7 May 2026

In this Presentation:

- Describe the Supination Resistance Test
- Objectives
- Elaborate on Research Methodology
- Results findings
- Discussion
- Recommendations and Conclusion

PRONATED FOOT 1



PRONATED FOOT 2

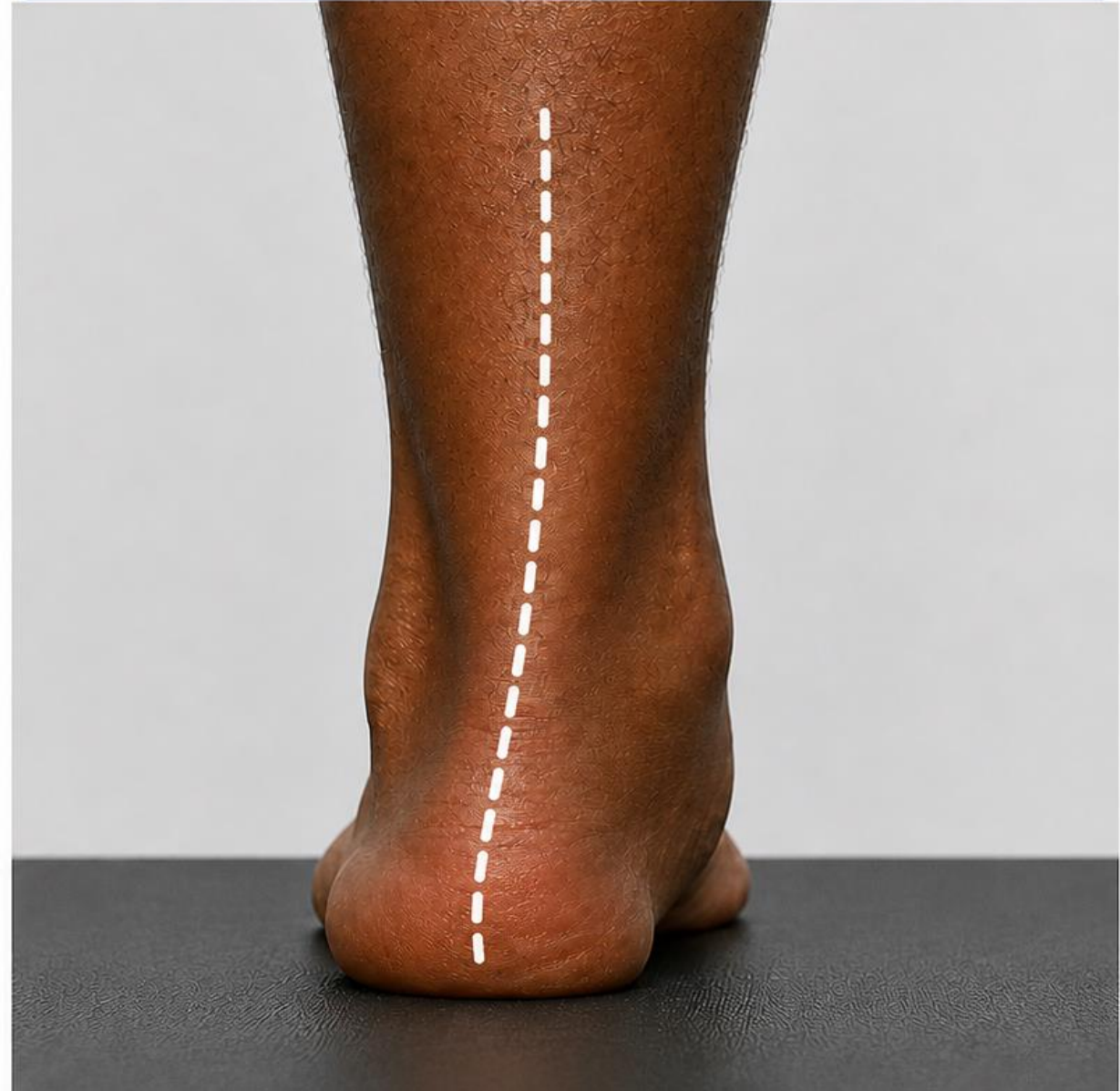


Figure 1. Rear view comparison of two pronated feet.

What is the Supination Resistance Test?

- Estimates the **external force** needed to initiate rearfoot supination during weight-bearing.
- Described by **Kirby's STJA** and **Rotational Equilibrium** theory. (1)
- Two fingers are placed beneath the plantar-medial aspect of the talonavicular joint.
- Apply an upward vertical force with your two fingers till rearfoot inverts.
- Grade the degree of difficulty using an ordinal scale from 0 to 5.



Figure 2. How to perform a Manual SRT:

The Keystone Device

- The only commercially available clinical tool for measuring Supination Resistance.
- Uses a strap-and-pulley system to measure the vertical force needed to initiate calcaneal inversion.
- Readings categorized:
 - Low: **<90N**
 - Moderate: **90 – 200N**
 - Hard: **200N+**



Figure 3. Instrumented measurement of SR using the Interpod Keystone device. Reproduced with permission from Chris Cox.

Literature Review Objectives

This study set out to answer three questions about the Supination Resistance Test:

01 Reliability

How reliable is the Supination Resistance Test?

02 Biomechanical relationship

What is the relationship between the Supination Resistance Test and foot & ankle biomechanics?

03 Variation across conditions

Does Supination Resistance vary across key foot and ankle musculoskeletal conditions?

Methodology

01

Database search

Search across
MEDLINE,
CINAHL,
Embase,
Scopus and
Cochrane
(n=391 records).

02

Inclusion

- Explicitly mentions Supination Resistance Test and Supination Resistance.
- Lower-limb focused
- English
- Enough methodological data to extract

03

Exclusion

- Upper-limb
- Paediatric-only
- Clinical/conference commentaries
- Cadaver work
- Case studies

04

SIGN **Grading**

- **8** studies appraised

Results

Reliability of the SRT

- Overall intertester reliability for Manual SRT (**ICC = 0.89**) (**good**).
- Experienced clinicians **ICC = 0.72-0.89** (**good**).
inexperienced **ICC = 0.56-0.62** (**poor**).
- Good intrarater (**ICC = 0.86**) and good interrater (**ICC = 0.76**) reliability for the **Keystone device**.
- **Excellent** reliability in PTTD (**ICC = 0.974**). (2-6).

0.95^{ICC}

Instrumented SRT reliability
vs 0.56 for inexperienced manual raters

-0.02^r

Correlation of SR with Foot Posture Index
Static posture does NOT predict SR

+25% / -32%

SR in PTTD vs CAI injured feet
Supports Kirby's STJ-axis framework

Figure 4. Summary of Key findings

Results cont...

SRT and Lower-limb Biomechanics

- Supination Resistance correlated with **STJ axis position ($r = 0.59$)**.
- Near-zero correlation with **FPI-6 ($r = -0.02$)** (2-4, 6-8).
- Static foot posture **does not** predict SR.

Results cont...

Variations across conditions

- Supination Resistance was significantly **lower** in **Chronic Ankle Instability (CAI)** (-32% , $p<0.001$) (see Fig. 5).
- **Higher in Posterior Tibial Tendon Dysfunction (PTTD)** ($+25\%$, $p<0.001$) compared to the contralateral foot. (See Fig. 6).
- Within PTTD, SR **increased** with disease stage (6,8).



Figure 5. Rear view of both feet showing chronic ankle instability, with visible heel varus.
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Figure 6. Rear view of both feet showing PTTD, with marked calcaneal valgus bilaterally.

Discussion

Reliability

- Instrumented devices (**Keystone**) are more reliable than the Manual Supination Resistance Test across raters and settings.
- **Manual Supination Resistance Test** works as a quick screening tool for **experienced clinicians**.

Foot Posture Index(FPI) vs Supination Resistance Test(SRT)

- Foot alignment alone is **insufficient** to determine the **corrective magnitude** of a **foot orthosis**.
- Supination Resistance captures dynamic loading information that static FPI cannot.
- Supination Resistance Test should sit alongside, not replace, posture assessment.

Discussion cont...

SRT in MSK conditions

- The Supination Resistance Test, therefore, supports a mechanism-based rationale for orthotic prescription across **Chronic Ankle Instability** and **Posterior Tibial Tendon Dysfunction**.
- **Valgus-inclined surface** increases Supination Resistance; simulates the effect of valgus-posted F.O, boosting the **corrective pronation moment** in **Chronic Ankle Instability (CAI)**.
- **Varus-inclined surface** reduces Supination Resistance by boosting the corrective supination moment to reduce the pathological pronation moment that the foot and ankle are unable to tolerate in patients affected by **Posterior Tibial Tendon Dysfunction (PTTD)**.

Recommendations for Future Research

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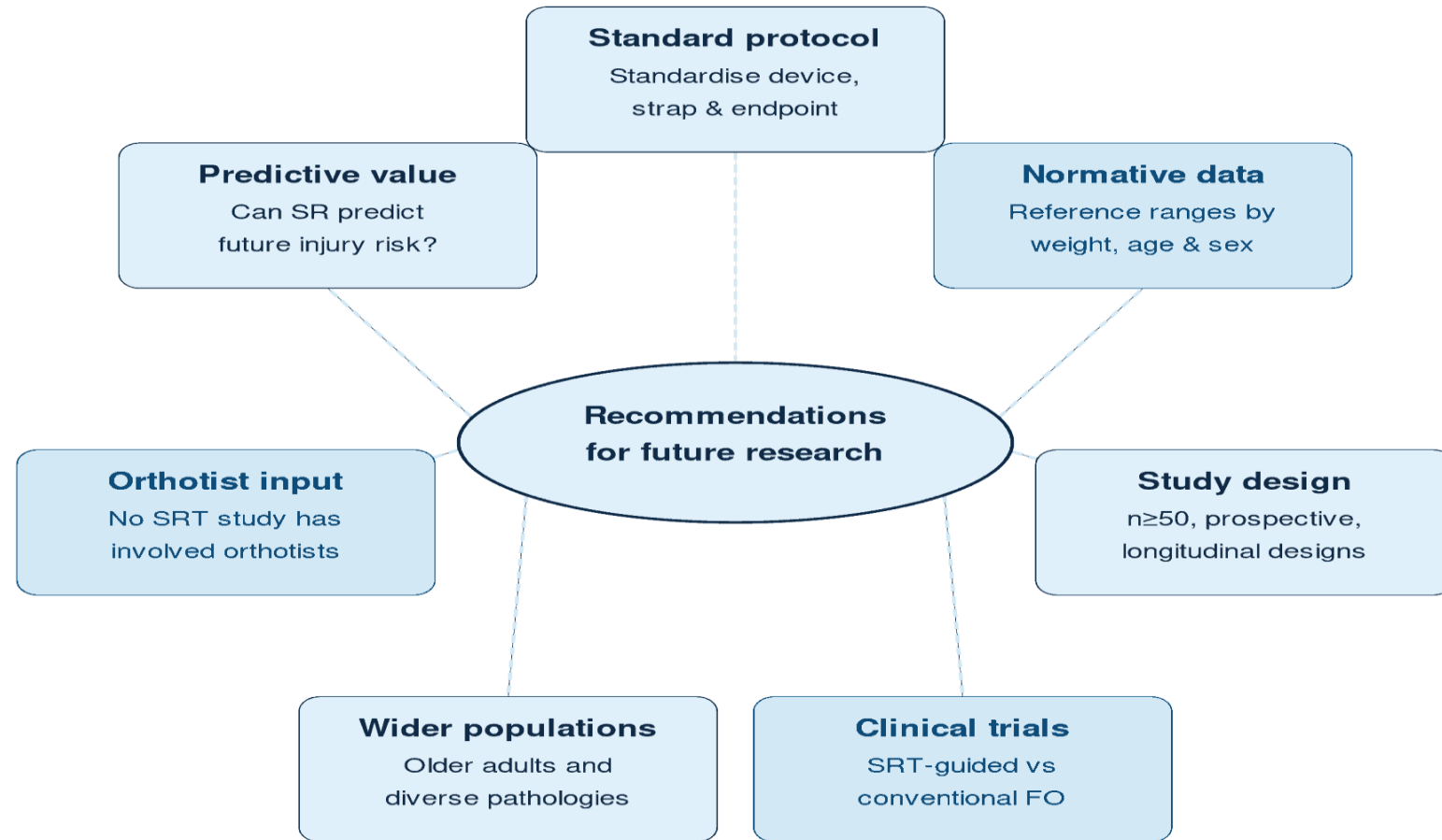


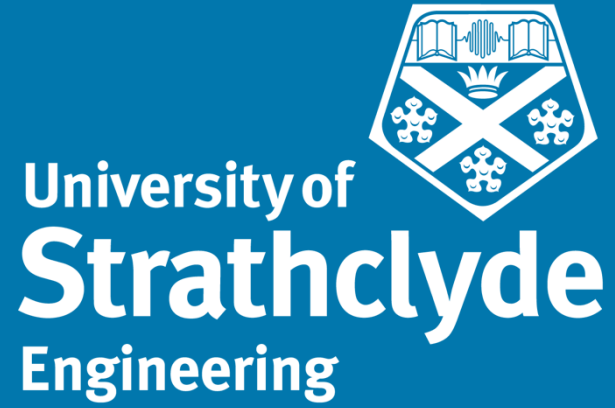
Figure 7. Recommendations for Future Research

Conclusion

- The Supination Resistance Test is reliable and biomechanically relevant, especially when instrumented.
- The keystone device retails for **£60.00**.
- This **inexpensive** clinical tool should be made available to **orthotists** and **students**.
- Helps to make informed decisions when prescribing foot orthoses.

Conclusion cont...

- Clear potential to guide orthotic prescriptions:
 - In **CAI**: **Valgus-inclined surface** increases SR; simulates the effect of **valgus-posted F.O**, boosting the **corrective pronation moment** in **CAI**
 - In **PTTD**: **Varus-inclined surface** reduces SR; supporting the use of **varus-posted F.O** to offload the **elevated pronatory moment** in **PTTD**.



THANK YOU

Questions & Discussion

Agyepong Eugene Opare

Supervisor: Christopher Cox | Biomedical Engineering, University of Strathclyde



Scan for References