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Validation of the Paper Pull Test for 1st Metatarsophalangeal Strength in Patients with Hallux Valgus and Healthy Controls

INTRODUCTION

Purpose: Explore the validity of the paper pull test (PPT) intrinsic muscle function.

Maximal MTP flexion force

Correlates to PPT force

Correlates to heel rise height

Intrinsic muscle activity during the PPT is less than maximum 1st MTP flexion and lower than the up and down phases of a heel rise.

METHODS

Foot Posture Index assessing for pronated/supinated foot posture.

Cross Sectional Area of FHB and AbH using diagnostic ultrasound[1].

Maximal contraction of FHB[2] and AbH in sitting.

EMG of FHB and AbH during maximal contraction, paper pull test, and heel rise.

Paper Pull Test

Heel rise for height

12 ♂ MALE

12 ♀ FEMALE

1 SUPINATED

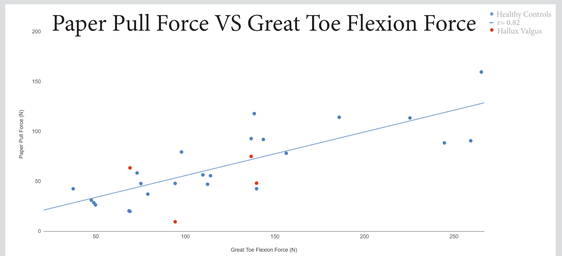
1 PRONATED

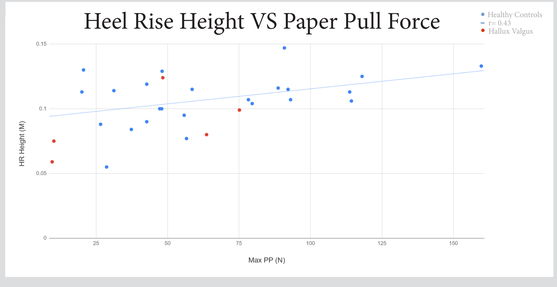
20-62 AGE

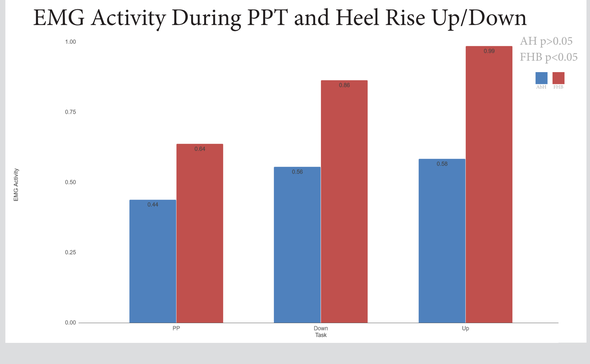
3 PRONATED

3 SUPINATED

RESULTS







DISCUSSION/CONCLUSION

Correlation between PPT force and maximum 1st MTP force was high (r=0.82, p<0.01)

Correlation of PPT force with heel height (r=0.43, p=0.04)

EMG results indicate AH is not a limiting factor in the HR or PPT. While FHB could limit HR.

Paper pull test can be used to identify intrinsic muscle function when heel rise height is limited

Low heel rise height potentially can represent combined intrinsic/ extrinsic muscle dysfunction

CONCLUSION

- The PPT appears valid for assessing 1st MTP flexion force capacity.
- PPT can be used to differentiate intrinsic vs extrinsic muscle weakness with a low HR height.
- Future studies: Analyze timing of AH and FHB contraction during HR and PPT.

WHAT IS NEXT

Continuation of research to determine a cut-off score via ROC curve for the paper pull test to assess when foot intrinsic muscle strength is limited in order to predict if a pathology of the foot is present.

REFERENCES

1) Angin, Crofts, Mickle, & Nester. (2014). Ultrasound evaluation of foot muscles and plantar fascia in pes planus. Gait & Posture, 40(1), 48-52.

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