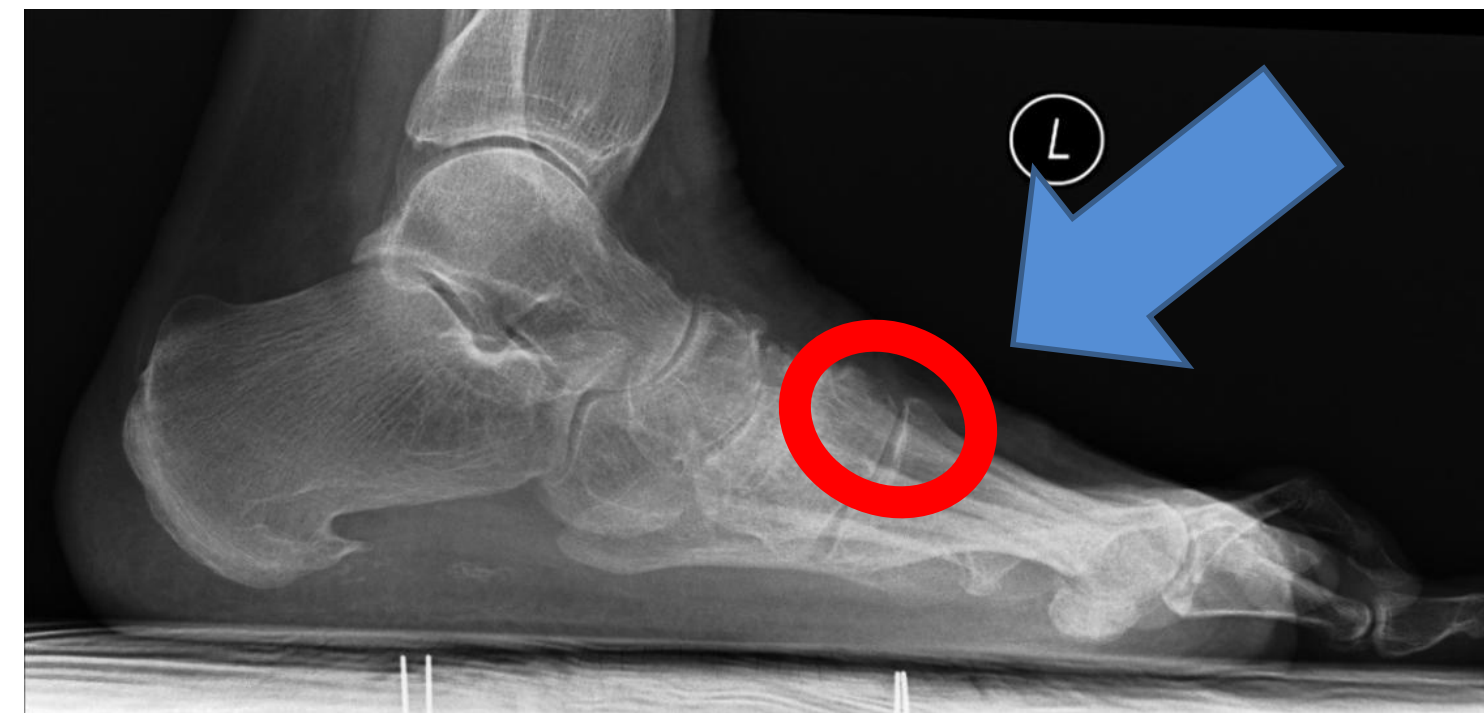


Factors contributing to Self-Reported Outcomes in Patients with Midfoot Arthritis



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INTRODUCTION

- Midfoot (tarsometatarsal) arthritis is a challenging problem due to its high potential for chronic foot pain and functional disability.
- In recent years, the incidence of midfoot arthritis has increased at an alarming rate as a consequence of plantar impact sustained in restrained motor vehicle trauma. In addition, as our population ages, chronic increased joint loads sustained with high heeled footwear may contribute to the development of midfoot arthritis.
- Individuals with midfoot arthritis experience foot pain which limits their participation in walking and weight bearing activities.
- Based on clinical experience, factors such as plantar loading, abnormal foot motion and severity of arthritic changes have been postulated to contribute to patients' self-reported outcomes, characterized by foot pain and attendant disability. However objective evidence examining factors contributing to self-reported outcomes in patients with midfoot arthritis is lacking.

The purpose of our study was to examine the relationship between plantar loading, foot motion and arthritis disease severity, and self-reported outcomes in patients with midfoot arthritis.

METHODS

- **Patients:** All procedures were approved by the IRB. 30 patients with midfoot arthritis participated in this study. All patients presented with foot pain localized to the tarsometatarsal region and sought care at the University of Rochester's Outpatient Orthopedic Foot and Ankle Clinic.
- **Self-reported outcomes:** The Foot Function Index - Revised (FFI-R), a region-specific instrument, was used to assess patients' self-reported function. The FFI-R comprises a composite score derived from the following subscales: pain, stiffness, activity limitation and psychosocial issues.
- **Disease Severity:** Kellgren-Lawrence (KL) grades were defined on lateral and antero-posterior radiographs at the transverse tarsal and tarso-metatarsal joints and rated by a single tester.
- **Plantar Loading:** Plantar loading during barefoot walking at self-selected, monitored walking speed was quantified using a pedobarograph (Novel, MN). Data were analyzed to obtain average pressure, contact time and mean force sustained on the medial midfoot.
- **Foot motion:** In vivo foot motion during barefoot walking was assessed using a previously validated 4 segment kinematic model. A magnetic tracking system (Flock of Birds, VT) was used to acquire kinematic data. Data were collected using the second-step protocol as patients walked at self-selected monitored walking speed. Euler angles, representing three sequential rotations (Z-Y-X) were used to describe joint motion (MotionMonitor, IL). Total range of motion values for all dependent variables were computed: calcaneal eversion, 1st metatarsal declination, 1st metatarsophalangeal joint (MTP) dorsiflexion.
- **Statistical Analysis:** All data were assessed for normality and correlations were assessed using Pearson's product moment correlation.



Figure 1. In vivo kinematic model and subsequent subject-specific anatomically based co-ordinate systems used to assess in vivo foot motion during barefoot walking

RESULTS AND DISCUSSION

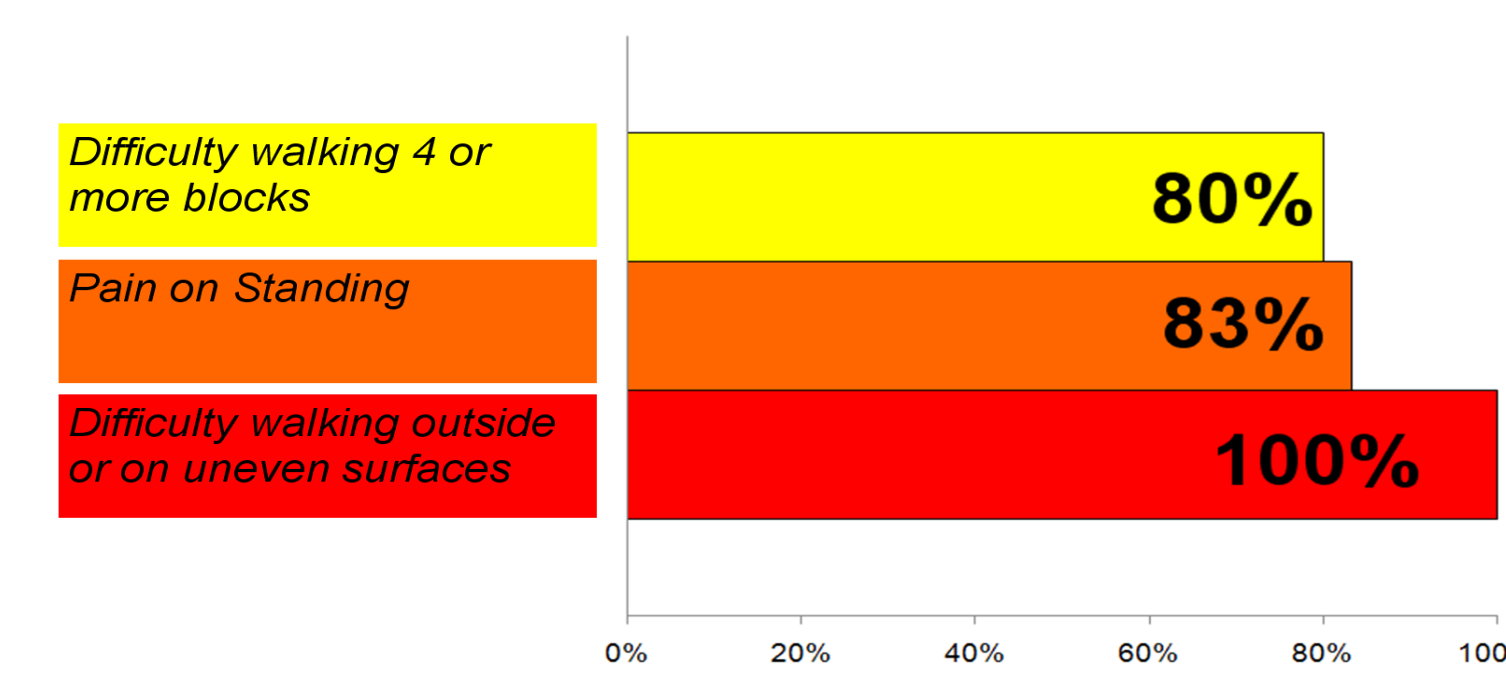


Figure 2. Percentage of patients reporting restrictions in weight-bearing activities of daily living

Dependent Variable	Patients with Midfoot Arthritis
Foot Function Index – Revised (Higher scores indicate worse symptoms)	
Pain	41 13
Disability	41 11
Activity Limitation	39 15
Psychosocial Issues	32 12
Total Score	38 11
Disease Severity (Higher scores indicate more severe radiographic changes)	
KL Grade	6.8 3.1
Plantar Loading at the Medial Midfoot	
Average Pressure (N/cm ²)	30.6 12.2
Contact Time (% stance)	49.5 5.7
Pressure Time Integral (N/cm ² .s)	31.8 8.7
Foot Range of Motion during Barefoot Walking	
Calcaneal eversion	9.6 4.8
1 st Metatarsal Declination	46.8 10.2
1 st MTP dorsiflexion	26.9 8.6

Table 1. Summary of dependent variables (Mean SD) in patients with midfoot arthritis

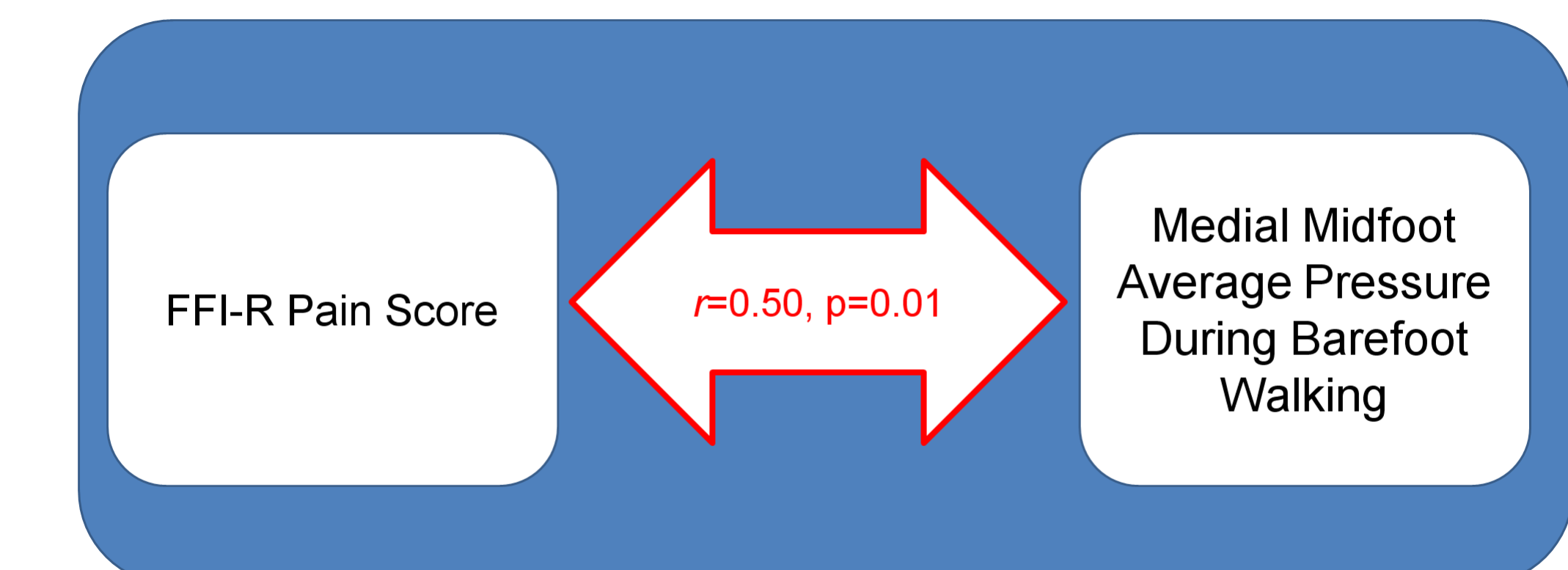


Figure 3. Foot Pain, characterized by the Pain Subscale of the FFI-R was directly co-related with Medial Midfoot Average Pressure sustained during walking

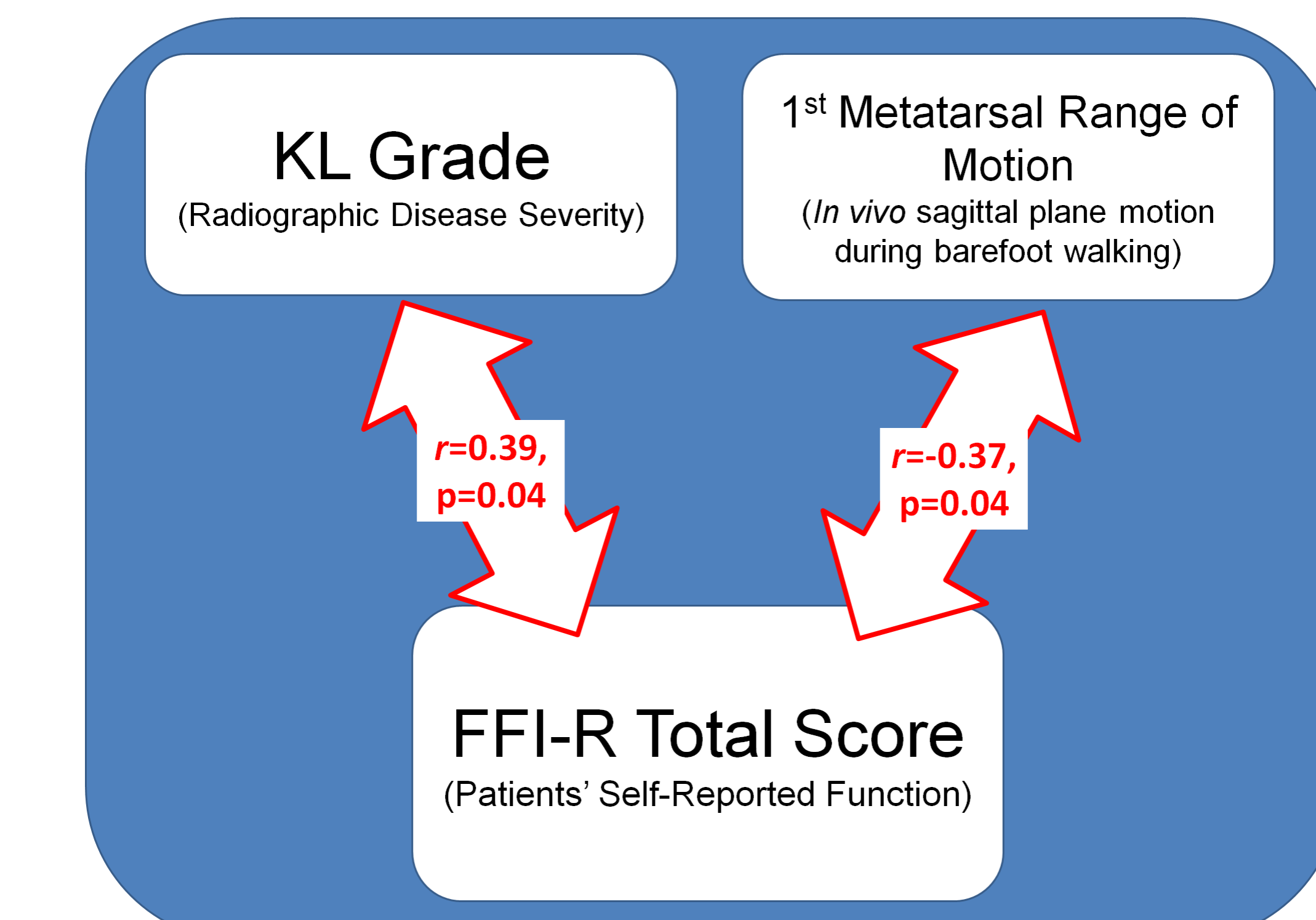


Figure 4. Disease severity, characterized by KL Grade was directly related to FFI-R Total Score. 1st Metatarsal Range of Motion during walking was inversely related to FFI-R Total Score.

CONCLUSIONS

- Patients with midfoot arthritis experience moderate to severe foot pain in weight bearing activities of daily living. Foot pain also contributed to limitations in recreational physical activity.
- 25% of the variance in foot pain was explained by the magnitude of medial midfoot loading, sustained during walking. Disease severity and in vivo motion of the 1st Metatarsal explained 15 and 10% of the variance in patients' self-reported foot function, respectively.
- These findings emphasize the significant disability experienced by patients with midfoot arthritis and highlight potential mechanisms by which interventions may influence patients' self-reported foot function.

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