Evaluating Recovery Following Total Ankle Replacement Using a Smartphone Application

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Disclosures

- Austin Sanders, BA – Nothing to disclose
- Kara Fields, MS – Nothing to disclose
- Grace Kunas, BA – Nothing to disclose
- Jonathan T Deland, MD – Arthrex: Consultant and receives royalties; Zimmer: Consultant; Wright Medical: Consultant
- Constantine C Demetracopoulos, MD – Integra: pain consultant and paid presenter or speaker; RTI Surgical: paid consultant; Stryker: Paid consultant and paid presenter or speaker; Wright Medical Technology Inc: Paid consultant and paid presenter or speaker
- Scott Ellis, MD – Wright Medical: Paid Consultant
Introduction

• With advances in mobile technology, smartphones now exist with sensors that can directly, continuously, and passively measure patient mobility.

• Research surrounding total ankle replacements (TAR) focuses on complications, gait analyses, and patient reported outcome measures of TAR.¹

• To our knowledge there are no studies assessing TAR by correlating step count and patient reported outcome measures.

• Automatic collection of daily step counts could show fluctuations in patient activity that could guide recovery guidelines.
Purpose

• Determine the change in step count following total ankle replacement (TAR)
• Validate the Moves app and step count with the Foot and Ankle Outcome Score (FAOS)

Hypothesis

• Step count following TAR will improve after surgery
• FAOS will improve despite increasing activity post-operatively
Methods: Study Design

- 45 patients undergoing primary TAR with working/compatible smartphones, <80 years of age were included.
Methods: Data Collection

- The Moves app
  - Uses the phone’s accelerometer to count daily steps
  - Installed on patients’ phones preoperatively through 9 months postoperatively

- Foot and Ankle Outcome Score (FAOS)$^2$
  - Completed via SurveyGizmo
  - Once pre-operatively, weekly from 3-6 months post-operatively, and biweekly from 6-9 months postoperatively
Methods: Analysis

- Change in step count and pain, quality of life (QOL), and functional scores as reported through FAOS from baseline to 3-9 months post-operatively was assessed using paired t-tests.
- The correlation of step count with survey scores was assessed via bivariate linear mixed modeling.
- Correlation coefficients are presented as point estimates with 95% bootstrap confidence intervals (CI) calculated from 1000 resamples.
Results

Assessed for eligibility (n=111)
August 2015 → April December 2016

- Never Reached (34)
  - Patient did not follow-up (14)
  - Surgery schedule <4 weeks (20)

- Eligible (56)

- Ineligible (n=21)
  - No smartphone (14)
  - Cancelling surgery (4)
  - Phone incompatibility (3)

- Declined (6)
  - Too busy (4)
  - Legal complications (1)
  - Not Interested (1)

- Dropped (5)
  - Drains battery

- Agreed (45)

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Results

- 45 patients: 26 females and 19 males
- Mean age = 63.6 years (33 years – 78.9)
- Function, pain and QOL all improved pre to post-operatively (p<0.001)
- Maximum daily step count increased postoperatively
  - 5,148 steps → 7,566 steps (p=0.002)
Results

Change in FAOS

- Mean FAOS pain improved from 39 pre-operatively → 73 post-operatively (p<0.001)
- Mean FAOS Function improved from 33 pre-operatively → 75 post-operatively (p<0.001)
- Mean FAOS QOL improved from 13 pre-operatively → 54 post-operatively (p<0.001)

Validity:
- Step count showed weak correlation with FAOS pain scores $\rho$ [95% CI] = 0.36 [0.18, 0.77]
- Step count showed very weak correlation with FAOS function scores $\rho$ [95% CI] = 0.13 [0.03, 0.45]
- Step count showed weak correlation with FAOS QOL scores $\rho$ [95% CI] = 0.36 [0.17, 0.77]
Conclusions

• Mobile technology can be used to show improvement and track recovery following TAR

• This application fails to correlate increased ambulation with qualitative assessments such as pain, function, and quality of life

• Despite weak correlations, pain, function and QOL all improved despite increasing ambulation in the post-operative period

• Limitations
  • Moves app – drains battery, does not provide additional information regarding heart rate or calories burned
  • Logistics – patients did not return phone calls so eligible patients were potentially missed, downloading an app proved to be a challenge for this patient population
  • Compliance with weekly surveys

• Next Steps
  • More user-friendly apps that provide more feedback regarding activity that do not use as much battery life
  • Set-up of tracking devices as part of standard of care so logistics are taken care of in-person rather than over the phone
References
