

Statement of Purpose

The goal was to evaluate the relationship of hallux interphalangeal joint (HIPJ) range of motion (ROM) and patient satisfaction following arthrodesis of the first metatarsophalangeal joint (MTPJ) using the revised foot function index short form (FFI-R) and Godin Leisure-Time Exercise Questionnaire (GLTEQ).

Literature Review

Arthrodesis of the 1st MTPJ is a commonly performed procedure used to treat deformity of the 1st MTPJ. It is frequently used for patients with hallux rigidus or hallux valgus deformity, in patients with rheumatoid arthritis with severe deformity or as a salvage procedure. Fusion of the joint provides long-term pain relief while maintaining the length and stability of the first ray (1). Prior research has evaluated long-term prognosis as well as factors which influence overall success of the procedure. Factors like increased HIPJ arthritis have been previously shown to negatively affect the success of the first MTPJ fusions (2). We know that patients with a hallux limitus deformity often develop a hyperextended position of the distal phalanx of the hallux. Joseph et al. previously found that dorsiflexion of the 1st MTPJ was decreased in older patients compared to younger patients but that HIPJ extension was greater in the older group (3). Munuera et al. looked at HIPJ extension in patients with and without reduced first MTPJ dorsiflexion (4). These patients with hyperextension at the HIPJ may eventually require arthrodesis of the first MTPJ if the deformity progresses. Desandis et al. looked at functional outcomes following 1st MTPJ arthrodesis using plate and screw or independent screw constructs. They found high overall satisfaction rates and low functional limitations in their patients regardless of the construct used (5). To our knowledge, no study has specifically evaluated the relationship of HIPJ ROM to satisfaction after 1st MTPJ arthrodesis.

Methodology & Hypothesis

A prospective review of 20 patients undergoing elective arthrodesis of the first MTPJ within Loyola University Health System between 2015 and 2018 has been evaluated using the FFI-R short form and the GLTEQ, both pre- and post-operatively. Patient satisfaction utilizing the FFI-R and the GLTEQ was collected, and this information was then compared to the preoperative HIPJ ROM to determine if HIPJ ROM had an effect on patient satisfaction following 1st MTPJ arthrodesis.

The criteria of inclusion in our study were: patients at least 18 years of age undergoing elective 1st MTPJ fusion; the criteria that excluded patients were: prior fusion of the 1st MTPJ or HIPJ on the planned operative side or other pedal fusion on the operative side.

Patients undergoing elective 1st MTPJ fusion at our facility were enrolled, 18 of 20 patients met our inclusion criteria. Pre-procedure HIPJ ROM was evaluated utilizing a two-arm scaled tractograph on the operative side. Patients completed the FFI-R short form and GLTEQ both pre- and post-operatively (completed between 5 and 15 months post-operatively with an average response at 10 months). The FFI-R short form is a self-reporting measure that assesses multiple dimensions of foot function on the basis of patient-centered values while GLTEQ evaluates leisure time physical activity.

Our null hypothesis is that hallux interphalangeal joint range of motion will impact patient satisfaction following first MTPJ arthrodesis and that overall patient FFI-R and GLTEQ scores will not increase post-operatively.

Procedures

Informed consent was obtained for patients meeting inclusion criteria for study. Prior to elective first MTP fusion, IPJ hallux range of motion was evaluated using a two-arm scaled tractograph. Patients also completed the FFI-R short form pre-operatively and after at least 5 months post-operatively. Additionally, radiographic measures were obtained upon evaluation of preoperative radiograph, immediate postoperative radiographs and the last available postoperative radiographs. Specifically the 1st MTP dorsiflexion was measured postoperatively and the hallux IPJ plantarflexion was compared preoperatively and postoperatively.



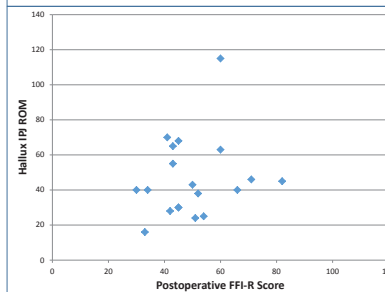
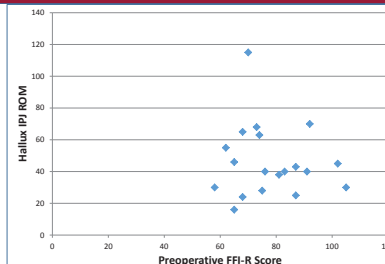
Figures 1 and 2 (Left), gives examples of radiographic measurements.

Results

Of the 19 patients in our study we found a statistically significant decrease in the preoperative FFI-R scores compared to the post-operative scores (p value of 0.0059). When comparing preoperative to postoperative GLTEQ scores there was a statistically significant decrease in the preoperative and postoperative scores (p value of 0.045).

When looking at the relationship between HIPJ ROM and postoperative FFI-R scores the lineal correlation coefficient value was calculated ($r=0.204$) as well as the lineal correlation coefficient between HIPJ ROM and point decrease in FFI-R score ($r=-0.1154$), both of which while showing weak relationships were not statistically significant.

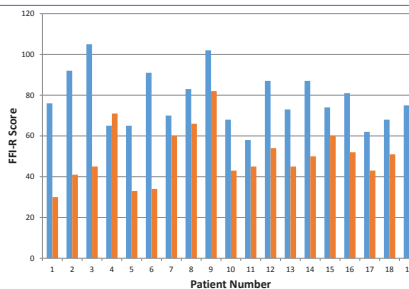
The radiographic evidence showed that out of 19 fusions performed, 5 were fixed with 2-crossed screws, 5 with a plate but no lag screw and 9 with a plate and lag screw. The change in 1st MTP dorsiflexion was measured on the initial postoperative radiographs and again at the last postoperative visit (usually 2-3 months after surgery). The change was noted to be highest in the plate but no lag screw group at a total of 3.02 degrees and lowest in the group using both a lag screw and plate at 1.69 degrees change. Postoperatively IPJ plantarflexion did not appear to correlate with type of fixation and was found to vary greatly among the different groups.



Figures 3 and 4 (Above), shows comparisons of Hallux IPJ ROM with preoperative and postoperative FFI-R scores.



Figure 5 (Left), highlights individual patient preoperative and postoperative FFI-R comparison.



Results Continued

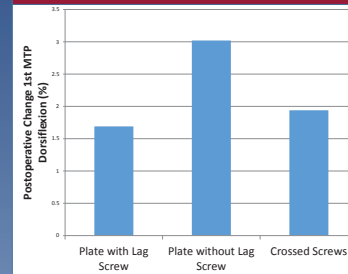


Figure 6 (Left), depicts change of degree of dorsiflexion in different fixation groups.

Analysis/Discussion

The FFI-R questionnaire evaluates pain, stiffness, difficulty, activity limitation and social issues related to patients' foot condition. Overall we found a statistically significant decrease or improvement in patients postoperative scores. This confirms previous research that functionally patients improve after first MTPJ fusions.

When looking at the relationship between HIPJ ROM and postoperative FFI-R scores we did see a positive correlation although very weak. Similarly, when looking at amount of decrease in FFI-R scores (indicating the most improvement in function post-operatively) there was a weak negative relationship with IPJ hallux ROM, indicating that (although very weak), the smaller amount of IPJ ROM the less patient reported satisfaction following an MPJ fusion.

Specifically looking at radiographic measures, we found a slightly higher increase in change of 1st MTP dorsiflexion after surgery with fixation using a plate without a lag screw. Although this is not statistically significant, it contradicts previous research that has shown this fixation construct to be equally as stable as the alternatives.

Our study is limited by many factors but most significantly the sample size. Among others are the length of follow-up, the inter-observer reliability in measuring joint range of motion. We hope that these results can continue to be expanded upon by further investigation.

References

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- (5) Jones, C. W., O'Daly, A., & Shah, A. (2016). Comparison of Patients Undergoing 1st MTP fusion with and without lag screw fixation for the treatment of hallux rigidus. *Foot & Ankle Orthopaedics*