Quadriceps Strength after TKA: A comparison of a Medial Pivot versus a Posterior Stabilized Knee Design at 6 weeks Post-Operatively

Dr. David K. DeBoer M.D., Dr. Michael J., Christie M.D.,
Southern Joint Replacement Institute, Nashville, TN

Disclosures:
DePuy, A Johnson & Johnson Company: IP royalties
MicroPort Orthopedics: Research support

INTRODUCTION

The Evolution Medial Pivot knee implant is designed to replicate the normal sagittal plane stability of the knee. Human and cadaver kinematic studies of the knee have validated the absence of paradoxical motion using the Medial Pivot (MP) knee as compared to traditional Posterior Stabilized (PS) knee implants[1]. Further electromyelogram studies comparing the sit to stand muscle activity in patients with either an MP or PS knee demonstrated decreased hamstring activity with the MP knee, suggesting greater sagittal plane stability and improved quadriceps efficiency using a MP knee[2]. The purpose of this study was to compare the return of quadriceps strength as a function of time in primary total knee arthroplasty (TKA) in subjects receiving either a medial pivot (MP) or posterior stabilized (PS) total knee implant. A handheld dynamometer, a validated tool for measuring quadriceps strength[3], was used as our strength measurement device.

Hypothesis:
The increased stability of the medial pivot knee results in improved post-operative strength at 6 weeks.

Fig 1. Medial Pivot Knee

Fig 2. Standard Posterior Stabilized Knee

Figures 1 and 2: Note the congruency of the Medial Pivot Knee compared to the Standard Posterior Stabilized Knee.

METHODS/MATERIALS

All subjects underwent a primary TKA using an MP or PS knee design with 50 patients in each cohort. The average of three knee extension strength trials at each fixed position of 90 degrees, 45 degrees, and 15 degrees of flexion were performed using the dynamometer. Measurements were conducted pre-operatively within two weeks of the index surgery and 6 weeks post-operatively. All patients' post-operative data was normalized to their pre-operative baseline to eliminate variability amongst subjects.

Fig 3. Handheld Dynamometer

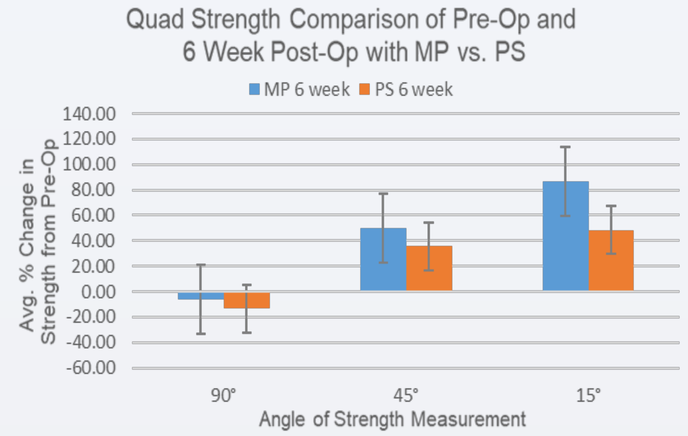
PATIENT DEMOGRAPHICS

Average age: 66 years old
Sex: M = 40, F = 47
Pre-Op Diagnosis: 100% Osteoarthritis
Average BMI: 33
Implant Type: MP = 46, PS = 37

RESULTS

All percentage increases or decreases in strength were determined by evaluating the change in strength from the post-operative time point to the subject's baseline. The average change in strength at 6 weeks at 90 degrees was -6.13% for the MP group and -13.25% for the PS group, at 45 degrees was +49.70% for MP and +35.53% for PS, and at 15 degrees was +86.82% for MP and +48.47% for PS. The average 30 second sit to stand test at 6 weeks for MP was 10.17 repetitions and 7.11 repetitions for PS. Although the MP group demonstrated greater strength at all flexion angles and the sit to stand test, only the 15 degree angle group showed a significant difference (p=0.026).

Fig 4. Percent Change in Quad Strength with MP vs. PS



DISCUSSION

At 6 weeks postop, the PS patients on average lost 14% of their quadriceps strength compared to 6% for the MP group. Improvements in strength compared to pre-op were noted for both the 45 and 15 degree tests. The MP patient's quadriceps strength was greater at each test angle compared to the PS group.

CONCLUSION

This data suggested a trend toward a more rapid return of quadriceps strength in the medial pivot knee compared to the posterior stabilized knee although statistical significance at the 95% confidence interval was achieved only at the 15 degree flexion angle.

REFERENCES

[1] Barnes CL, Blaha JD, DeBoer D, Stemniski P, Obert R, Carroll M.. Assessment of a medial pivot total knee arthroplasty design in a cadaveric knee extension test model. J Arthroplasty. 2012;27(8):1460-1468.

[2] LaMontagne M. Kowalski E, Galmiche R, Dervin G. Muscle Activity in Total Knee Arthroplasty Patients While Ascending and Descending a Ramp. International Society for Technology in Arthroplasty (ISTA) 31st Annual Congress. *Orthop Proceedings* 2019, 101-B, Supp.5

[3] Martin, H.J & Yule, V. & Dennison, Elaine & Cooper, C. & Aihie Sayer, Avan. (2006). Is hand-held dynamometry useful for the measurement of quadriceps strength in older people? A comparison with gold standard Biodex dynamometry. Gerontology. 52.

[4] microFet 2 - Hoggan Scientific. (n.d.). Retrieved from https://hogganscientific.com/product/microfet2-muscle-tester-digital-handheld-dynamometer/

SOUTHERN JOINT REPLACEMENT INSTITUTE

RESEARCH POSTER PRESENTATION DESIGN © 2015
www.PosterPresentations.com