

The Relationship Between Pre- and Postoperative Flexion Utilizing Three Cruciate-Retaining Knee Prostheses

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Statement of Purpose: Knee range of motion (ROM), and in particular flexion, are among the most important outcome parameters following total knee arthroplasty. Preoperative ROM is a strong predictor of postoperative ROM. The postoperative ROM tends to reach a middle ground, with knees having poor pre-op ROM gaining motion, those with excellent pre-op ROM losing motion, and those with intermediate ROM initially staying about the same. (1) As the specific relationship between pre- and post-operative ROM may depend upon implant design, continuing investigation of this is desirable so the surgeon and patient can have realistic expectations of outcome. We examined this relationship in a prospective clinical study that utilized three total knee prostheses - two with a flexion potential of about 130-135° and one with a flexion potential of about 140-145°. The study hypothesis was that all knees would demonstrate a similar pre- vs. post-operative flexion relationship, with the high flex knee demonstrating superior flexion.

Methods: Three cruciate-retaining total knee prosthesis were prospectively studied following IRB approval. These were the high flex Vanguard™ CR knee (45 knees, age 71.3±9.3 years), the Maxim® PCR (71 knees, mean age 66.8±10.9 years), and the Maxim® PCR (40 knees, age: 71.3±8.8 years) with a posterior lip in the polyethylene liner (all from Biomet Orthopedics, Inc., Warsaw, IN). The Vanguard™ knee utilized a mini-subvastus approach utilizing hybrid fixation while the Maxim® knees (both types) utilized a medial parapatellar approach and all cemented fixation. Passive ROM was measured preoperatively and 12 months postoperatively. The differences in technique were unlikely to influence 12- month results. The patients were placed into three groups based on pre-operative flexion, i.e., <90°, 91-105°, and >105°. The mean delta flexion was calculated from the paired differences, on a patient basis, as the difference in flexion at follow-up compared to the pre-op value. As such, within each of the three groups were outcomes from patients having all three of the knee implants. The analysis was taken further by subdividing each of these three groups by implant type, resulting in nine groupings, with each group corresponding to a given implant design and a given pre-op flexion. Statistical comparisons were made by performing a one-way analysis of variance followed by a *post hoc* Student-Newman-Keuls test, with significance taken for $p < 0.05$.

Results/Discussion: At one year, flexion for all three knees averaged 116-122°, all equivalent, and exceeding the minimum requirement. Figure 1 shows the 12-month mean delta flexion based on the three pre-op flexion groupings. For the <90°, 91-105°, and >105° groupings, the means were 23.6°, 19.3°, and 1.8°, respectively, showing a trend toward greater improvement with poorer initial knee flexion. The mean delta flexion for the best preoperative group (1.8°) was significantly smaller than

that of the other two groups. Figure 2 shows the 12-month mean delta flexion values for the nine groupings, segregated by pre-op flexion and implant. Overall, there was a general trend toward less gain in flexion for better pre-op flexion. The most important grouping of Figure 2 is that corresponding to the patients with the best pre-op (>105°) flexion since it is recognized that these patients typically show little gain, or even loss, of motion post surgery. (1) The high flex Vanguard™ knee showed a 9.7° mean increase in flexion while the Maxim® PCR knee showed a 2.9° increase - not significantly different. This difference was not significant. The Maxim® PCR/Lip knee yielded a flexural loss of -7.4°, which was significantly different that that of the other two knees.

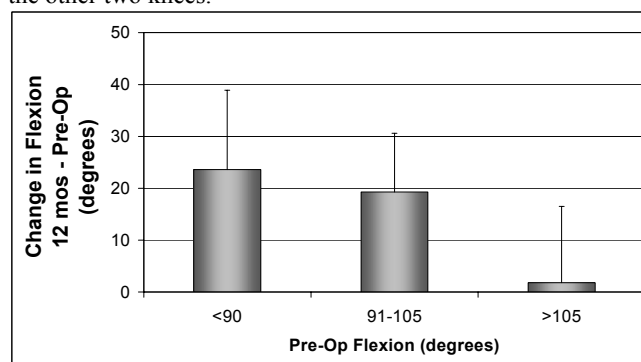


Fig 1. Mean delta flexure vs. pre-op flexion.

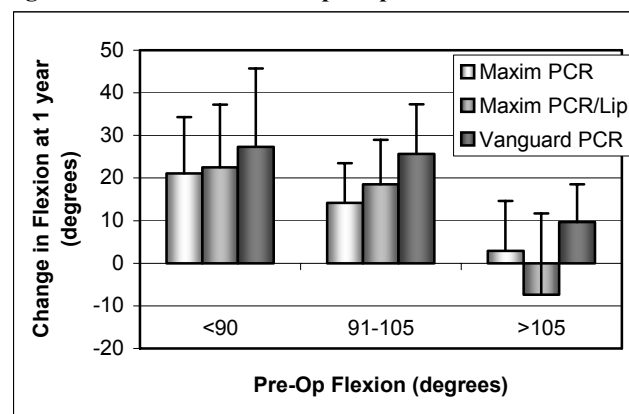


Fig 2. Mean delta flexure vs. pre-op flexion and knee.

This study helps to confirm the general relationship between pre- and post-op flexion following total knee arthroplasty. It also suggests that use of a high flex knee can have particular benefit for patients with very good pre-op flexion.

Conclusions: Although there is a general relationship between pre- and post-op knee flexion, the particular knee design used can influence this relationship. This is especially true for patients with very good pre-op flexion. Such knowledge is important for both the patient and the surgeon to maximize outcome potential and foster realistic expectations.

References:

1. Anouchi YS. Clin Orthop, 1996;331:87-92.