Chapter 3. Results

Baseline Characteristics of Patients

The 62 studies that had pre- and post-functional data using one of the four established outcome measures (ie, the Knee Society score, the Hospital for Special Surgery score, the WOMAC, or the SF-36) are summarized in Appendix F, Evidence Table 1. All were simple pre- and post-comparisons. Although various demographic information is provided to describe the sample, that data were rarely and inconsistently used in the reported analyses.

Table 3 presents a summary of selected patient and clinical characteristics. We used the full sample from each study whenever possible. Because of the variation in reporting practices here and elsewhere, the mean rates were calculated using means weighted separately on the basis of the numbers of knees and patients in the studies. The data here used weights for numbers of patients and knees, as well as the raw averages. The weightings made little difference. Two studies did not report the numbers of patients. The discrepancy between the numbers of patients and knees reported is an artifact of which studies reported knees.

The average age of patients was approximately 75 years. Very few were over 85; about two-thirds were female; about one-third were considered obese (using a criterion of a Body Mass Index (BMI) of 30 or higher). Nearly 90 percent of patients had osteoarthritis. One-third of subjects underwent bilateral TKA. None of the studies provided information regarding racial/ethnic status. We did not separately address outcomes for patients undergoing bilateral TKAs from those undergoing unilateral procedures. However, we conducted separate analyses by numbers of knees and numbers of patients.

The most commonly used functional measures were the Knee Society score and the Hospital for Special Surgery scale. A major factor in their greater usage is likely the fact that they have existed longer. The WOMAC Arthritis Scale is considered by many in the field to be a psychometrically better measure, but it has only been used since 1991.[8] The physical function component of the SF-36 is a generic functional outcomes measure, not specific to knees.

Table 4 presents the summary data on the mean duration of study followup periods according to the type of functional outcome assessment scale used. The results are shown using various approaches to weighting the numbers of cases used. They were weighted separately by the numbers of patients and the numbers of knees. Because there is substantial sample loss, we then divided each of these categories to weight by the numbers at baseline and at followup. Several studies used more than one scale. In comparison to the demographic data cited above, there is greater variation when the different weights are applied. When weighting by numbers of patients, the generic measure (the SF-36) was used for shorter followup periods. In general, determining the sample sizes at different points in time was difficult. A substantial number of studies failed to provide adequate data to identify how many patients (or knees) were available at followup.

The longer established measure KS score is associated with longer followup periods, perhaps because it was in use earlier, allowing more time to elapse for such followup. For example, weighting for baseline patients the mean followup for KS and HSS is 66 and 67 months, compared to 45 months for WOMAC. However, weighting for baseline knees, KS has a mean followup of 90 months and WOMAC is 68 months, but HSS is only 61 months. The longest mean followup time was 90 months (KS score weighted for baseline knees), well less than the

ten years that has been suggested in order to evaluate long term functional results. Only ten studies had followup time of at least ten years.

Some information on attrition rate was reported for 49 studies. Of these the median percentage of subjects lost to followup was 2%, the range was 0-28%. In five studies more than 10% were lost to followup. If death and other exclusions are added to the definition, the range increases to 0-56% with a median of 12%. Five studies had a total loss rate of more than 40%; another five lost 30-40%; and another seven studies lost 20-30%.

The issues of outcomes addressed here looked at only the aggregate outcome in the context of having had a TKA. No special efforts were made to distinguish the relative contribution of rehabilitation or type of procedure. Although the latter was the major focus of many studies, few actually compared alternative approaches.

What is the Magnitude of Effect of Primary TKA?

Table 5 summarizes the raw data on change from pre- to post-TKA functional scores (albeit with widely varying followup periods). In each scale the range has been defined as 0-100. In general, a higher score is better, although the WOMAC was standardized such that a lower score is better. In each case there is strong evidence of improved function (and decreased pain). Of the 46 studies using KS scores only 30 provided pre- and post-intervention results according to the number of subjects enrolled (n = 12,261 subjects) (27 provided this information based on number of knees (n = 15,454 knees). There were 17 studies using HSS scores (2,546 patients) Seven studies, representing 2,925 patients reported results with the WOMAC.

Table 6 shows the mean scores at baseline and followup for each of the four major scales, organized by length of followup, analyzed in terms of patients; Table 7 shows the same data analyzed by knees. Baseline scores were highest in studies using the HSS and lowest in studies using the KS. This may reflect differences in severity of pain and function among subjects enrolled in these studies. HSS scores improved by about the same order of magnitude for each followup period; baseline scores were in the mid 50s and followup scores were in the high 80s and low 90s. The same general pattern applied to the KS scores but the results were a little less dramatic. The baseline values were in the high 30s and low 40s and the mean followup scores were high 70s and low 80s. The WOMAC scores showed more variation; the studies addressing followup at less than five years showed baseline mean values in the high 40s and followup values in the 70s, but the single study with more than five years of followup showed a mean baseline of 58.2 and a followup mean score of 98.4. The SF-36 mean functional scores increased from the mid-20s to the mid 40s, a level that still shows substantial limitations. Although there is no formal basis for translating the size of a change in the scores, the generally accepted rule of thumb for the KS and HSS scales is that a score of less than 60 is considered poor; 60-69 represents a fair results; 70-84 is considered a good results; 85-100 is considered an excellent result.

Tables 8-11 display the effect size (defined as the number of standard deviations of change) for this same data. The functional scores after TKA are consistently higher. The mean effect size for the HSS studies is 3.91 for those with followup up to two years, 3.01 for those 2-5 years, and 2.97 for those studies with more than five years of followup. For the studies using KS scores the mean effect size is 2.35 for those 0-2 years, 2.73 for those 2-5 years, and 2.67 for those 5+ years. For WOMAC studies the mean effect size for 0-2 years of followup is 1.62. The more generic

SF-36 scores had the smallest mean effect size; for the studies with 0-2 years of followup it was 1.27 (though this is still considered a "large effect size"). The effect size is considerably higher for those studies where the clinician reports the results compared to those where patient reports are used.

Revisions and Complications

Revision rates were calculated in several ways. The basic data are shown as an evidence table in Appendix F, Evidence Table 2. Table 12 summarizes the revision rates for primary TKAs. The results are organized to show the rates at different followup intervals and are grouped by both knees and patients. The revision rates are further subdivided into operations specified as revisions and all procedures performed on the knees in question. The revision rate through five or more years is 2.0 percent of knees and 2.1 percent of patients.

The data base used to calculate perioperative complication rates (defined as occurring within six months of the TKA) is shown in Appendix F, Evidence Table 3. Complications were defined by each investigator. The vast majority were "knee related" or deep venous thrombosis. When the unit of analysis was numbers of knees operated on, the complication rate was 5.4 percent; when the denominator was numbers of patients, the rate was 7.6 percent. There were essentially no cardiopulmonary complications reported. Given the number of elderly subjects undergoing a major surgical procedure this suggests that these adverse effects were not addressed in the literature.

Although the sampling approach was not specifically designed to search for all outcomes associated with using different types of prostheses or different surgical approaches, we did analyze the studies that fell within the search parameters. In some cases it was difficult to classify a study as primarily addressing either the use of a specific type of prosthesis or testing a specific surgical procedure or technique. Several studies reported prostheses that were used in specific types of procedures. Table 13 is arranged to attempt to classify the emphasis of studies by procedure or prosthesis, but some overlap is inevitable. A number of the studies of prostheses were case series that reported generally good results. A few tested the use of a prosthesis with a specific group of patients. The studies of procedures were a mixture of case studies and comparative studies.

TKA studies assessing prophylaxis for postoperative deep venous thrombosis (DVT) or infection were identified by searching the 611 references meeting and not meeting inclusion criteria. The *Cochrane Library* was also searched back to 1994. The investigators decided *a priori* to include only randomized controlled trials (RCTs) with the exception of large cohort studies. Fourteen studies were identified and extracted; nine DVT, three infection, and two tourniquet studies. All included studies were randomized controlled trials with the exception of one large cohort study.[24] One trial was identified through The *Cochrane Library*.[25]

Several other procedures, which involved primarily non-surgical elements of care, were also described. These are summarized in Table 14. Three of these addressed the use of continuous passive motion as a rehabilitative approach; two studies were positive. The other two studies tested different clinical pathways and showed mixed results.

The review of randomized trials addressing prevention of venous thrombosis and pulmonary embolus uncovered several studies that tested various approaches to anticoagulation and other

preventive techniques. These studies are summarized in Table 15. Two studies suggest that compression ultrasonography is not justified. Two find drug therapy better than mechanical approaches. Several studies compared anticoagulant drugs and drug regimens.

Table 16 summarizes three randomized trial that address infection prevention. Each compares alternative antibiotic regimens.

Table 17 shows two randomized trials that tested the use of tourniquets in performing TKAs. One concluded tourniquets were safe and the other that they did not reduce surgical complications.

What are the Correlates of Functional Outcomes?

We differentiated "indications for TKA" from "correlates or factors related to outcomes." The former addresses what factors are needed to warrant a TKA (or conversely, what factors are contraindications to TKA either because the procedure is ineffective, unnecessary, or places the patient at unacceptably high perioperative risk); whereas the latter addresses whether outcomes vary according to the clinical or demographic factors. The number of studies that employed any analytic technique examining the functional outcome in terms of at least one independent variable of interest was limited. Table 18 illustrates this point. (Indeed, the list may over-encompass in that it includes any analysis, whether or not the dependent variable came from one of the four functional measures assessed. Also, we counted instances where the analysis was alluded to, even if the results were not specifically shown.) It should be noted that the table is organized such that any study using a combination of variables will also be counted for an individual variable. Thus, a total of only 12 of the 69 studies used any analysis that directly assessed the relationship of these patient variables to a change in functional status. The descriptor most frequently used in an analysis was BMI, followed closely by age and the type of arthritis. In some instances, the report indicated an explored relationship but the specific statistical details of the analysis were not given.

Table 19 summarizes the results from the few studies that examined the relationship between patient characteristics and outcomes. Neither age nor obesity seems to be significantly correlated with TKA outcomes. In one small study, patients over age 80 (n=35) had similar improvement in pain, function, and stiffness after six month followup compared with patients less than age 80 (n=221) as evaluated by the WOMAC. Another study by Stickles (n=962) reported a trend toward greater improvement from baseline WOMAC with higher BMI (57 percent improvement from baseline for BMI >40 vs. 36 percent for BMI <25; p=0.08 for trend). In one study of 120 subjects, those with rheumatoid arthritis (n=81) had a greater percent improvement from baseline in HSS than those with osteoarthritis. However, most of these analyses examined only one independent variable at a time in simple bivariate analyses. For example, obese patients and those with rheumatoid arthritis had lower (worse) WOMAC scores compared with less obese patients or those with osteoarthritis. Therefore, improved scores at followup could be due to more severe disease preoperatively rather than the type of arthritis or presence of obesity. The few studies that did use more sophisticated statistical methods reported on followup results at one year or less but deserve further attention. Table 20 summarizes the five studies that used multiple regression analyses. All but the study by Hawker evaluated fewer than 300 subjects. The Jones study employed stepwise regression, which may eliminate variables whose contribution is accounted for by another variable.[26] They used separate models for the two

components of the WOMAC score. For pre/post change in pain the authors found no significant relationship for age, sex, and BMI at six month followup in patients with predominantly osteoarthritis. The significant patient predictor was preoperative bodily pain (from the SF-36). Other significant predictors were hospital length of stay and use of a cementless prosthesis. For change in function, the three patient factors (age, sex, BMI) were also not significant predictors. In this case, the significant predictors of function were length of hospital stay and preoperative pain, as well as preoperative joint pain and the number of comorbid conditions. That is, patients with a longer length of hospital stay, greater preoperative pain, and comorbid conditions had a larger improvement in function.

The study by Deshmukh employed hierarchical multiple regression but did not show the actual results.[27] In looking at changes in function and pain at 12 months post TKA as measured by the KS score, the authors controlled for age and sex. Their results indicated that BMI accounted for only a small amount of the explained variance.

Fortin et al. used multiple linear regression analysis to examine the effects of age and gender on WOMAC scores at six months.[28] There were no significant relationships between these characteristics for either pain or function.

A large study comprised primarily of Canadian women with osteoarthritis analyzed several sources of data in a stepwise multiple regression model with WOMAC scores as the dependent variable.[29] They found that age, gender, and BMI were not significant predictors of knee pain. However, a lower BMI did predict better physical function and greater satisfaction with the procedure.

The study by Konig used multiple linear regression analysis to assess KS scores at two years.[30] Age, gender, and BMI were not significantly related to pain or the overall KS scores. However, BMI did correlate with function.

Does Access to TKA Vary with Race and Gender?

The six studies that addressed TKA-related access issues according to race or gender are shown in Table 21. Several of these studies included both hip and knee replacement surgery. Most of the studies that address access relied on large administrative data sets, which did not contain detailed clinical data on which to base the indications for knee surgery. However, some of these studies had at least some clinical information on the underlying problems of the sample being studied. Dunlop used the AHEAD data set, which has self-reported conditions including arthritis.[31-33] Hawker identified persons with arthritis as the basis for their sample.[31] Wilson limited their study to Medicare beneficiaries with a diagnosis of osteoarthritis.[33]

The conclusions with regard to the differential treatment of women are mixed, but the preponderance of evidence suggests that women are almost twice as likely to undergo a TKA as men. The evidence regarding non-white groups is quite consistent. Non-whites receive TKAs about half as often as whites. Table 22 summarizes that evidence. With the exception of those by Hawker, Dunlop, and Wilson, studies address simply the rate at which the procedures were performed, with no attention to the actual size of the population at risk.[31-33] The results are often expressed as odds ratios, which compare the risk of one group receiving the procedure with that of another group. The argument that the higher rates of TKAs in women may be due to the higher prevalence of arthritis among women does not apply to the study by Wilson, which

examined only persons with arthritis. However, it is possible that the severity or type of arthritis (OA vs. RA) varied. Conversely, the lower rates of TKAs among blacks occurred despite a higher prevalence of osteoarthritis in this group, suggesting that the prevalence of osteoarthritis was not a mitigating factor. The study by Wilson looked at race and gender simultaneously. They report the odds ratio of race for TKA is almost the same for men (0.32) and women (0.37), and conversely the odds ratio of female gender for whites (1.26) is less than for nonwhites (2.57).

Total Knee Arthroplasty Revisions (TKAR)

(Summary and Update of the Systematic Review by Saleh et al., 2002)

Like all biomedical devices, total knee replacements can fail over time.[34] The primary factors believed to cause TKA failures (and thus require consideration for TKA revision-TKAR) include trauma, chronic progressive joint disease, prosthetic loosening, and infection of the prosthetic joint. Coincident with the increased incidence of primary TKA, there has also been an increase in the number of TKAR procedures.[35] In 2001 Medicare paid for 16,895 TKAR procedures.[9] The number of TKAR procedures is expected to continue to increase by approximately 14 percent annually as a result of complications associated with TKA, including infection, fracture, and time-dependent implant failure that necessitate re-operation.[36]

As noted earlier, information on indications differs from that for outcomes by requiring a broader set of observations with which to distinguish the clinical outcomes for those treated and untreated. Unfortunately, the data for TKAR is even more limited than for primary TKA. There are limited long-term TKAR outcome data reporting knee specific or global knee scores. Callahan et al defined a generic global knee score as "an instrument that measured patient outcomes in the domains of pain, function, and range of motion and combined these domains in a summary scale."[5] Examples of such scales include the Hospital for Special Surgery score (HSS) and Knee Society (KS) score. However, we also grouped over 30 other knee instruments that measure the same domains that under the same heading.

The primary assessment of the outcomes of TKAR for this report is derived from a systematic review of the literature published through 2000 that was done by one of the principals (shown as Appendix E). Additionally, we updated this report with articles published through June 2003. The objective of the original systematic review was to describe patient outcomes following TKAR procedures using GKS ratings. English Language articles published from 1966 through 2000, were identified through a computerized literature search and bibliography review. The specific aim was to describe patient outcomes following TKAR procedures by using GKS to address the following questions:

- Does TKAR improve function as measured by increase in GKS?
- Is there correlation between outcomes and preoperative disease severity as measured by GKS?
- What proportion of TKAR subjects attains excellent/good (E/G) postoperative results and what proportion attains satisfactory/poor (S/P) results?
- Does the proportion of subjects with E/G results, or the postoperative HSS score / KS score, vary with the length of followup, the year of study publication, or preoperative diagnosis (i.e., infection, loosening, etc.)?

- Is there a difference between the multiple and single knee revision cohorts in the percentage of subjects that attain E/G postoperatively?
- Is there a difference between the multiple and single knee revision cohorts in the preoperative HSS or KS scores or the score increases?

We report a summary of the results from the original systematic review and then describe findings from our review update of new articles published between 2000 and June 2003.

Does TKAR improve GKS and is this improvement related to preoperative disease severity?

There was a large improvement in GKS scores following TKAR that was both statistically and clinically significant. As noted earlier, the KS score can be subdivided into pain and function subscores. The preoperative *combined* mean KS score was 35.4 (95% CI 30.7-39.9). There was an increase of 30.8 (95% CI 26.6-35.0) points to 66.2 (95% CI 61.8-70.2) points postoperatively ($p < 0.0001$). The preoperative *functional* mean KS score was 30.4 (95% CI 22.8-37.9) with an increase of 27.0 (95% CI 21.8-32.2) points to 57.4 (95% CI 51.6-62.7) points postoperatively ($p < 0.0001$); the preoperative *clinical* mean KS score was 32.8 (95% CI 25.5-40.0) with a highly significant increase of 42.1 (95% CI 39.2-45.0) points to 74.9 (95% CI 68.6-80.8) points postoperatively ($p < 0.0001$). The latter two subscales were on a subset of the 15 studies on which combined results could be calculated. The preoperative *mean* HSS score was 51.5 (95% percent CI 48.9-54.1). There was an increase of 28.3 (95% CI 25.3-31.2) points to 79.8 (95% CI 76.4-83.1) points postoperatively ($p < 0.0001$). However, we found no significant correlation between the preoperative score and the amount of improvement in either the overall KS ($r = -0.09$, $p > 0.7$) or the HSS ($r = -0.263$, $p > 0.3$) studies suggesting that improvement in symptoms were not associated with preoperative knee status.

Do patients undergoing multiple TKARs have more severe disease as judged by preoperative GKS scores compared with single TKAR cohorts?

Although there was no difference in age or gender between the multiple and single knee reports, there was a significant difference in preoperative HSS. Patients undergoing "multiple knee TKAR" had lower preoperative scores (multiple knee HSS = 49.5, 95% CI 45.9-53.2; single knee = 54.5, 95% CI 51.4-57.5; $p < 0.1$). These results suggest that the multiple knee cohorts may have more severe disease then subjects evaluated in single knee TKAR studies. In contrast, the preoperative combined mean KS score in the multiple knees group was higher (77.0, 95% CI 64.2-89.8) than the single knee group (59.85, 95% CI 45.2,-4.5), $p > 0.1$. This result, however, was heavily influenced by a very low preoperative combined score of 32.8 (25.5-40.0) in one large study (n = 574 subjects or 598 knees).[37]

Do outcomes vary between multiple and single TKAR groups as measured by KS or HSS?

There was no difference in the pooled change in either the KS or HSS from pre- and postoperative scores when comparing subjects undergoing multiple vs. single TKAR ([KS multiple knee = 60.0, 95% CI 49.4-70.5; KS single knee = 64.4, 95% CI 50.3-78.5; nine studies and 953 patients/1,001 knees. [HSS multiple knee = 28.9, 95% CI 25.5-32.3; single knee HS = 27.2, 95% CI 22.5-32.0; ten studies and 1,010 patients/1,050 knees. The mean difference in both GKS increased over time up to around 60 months. Thereafter KS (Figure 2) and HSS marginally declined (Figure 3).

What proportion of TKAR subjects attains excellent/good (E/G) results postoperatively as measured by GKS? Do results vary between the multiple and single knee cohorts, length of followup, or presence of infection as the proximate cause for revision?

The percentage of subjects undergoing TKAR who attained a self-reported E/G result postoperatively was 77.7% (95% CI 75.2-80.2). In studies reporting on cohorts where some subjects had both knees revised the percentage of subjects attaining E/G was 72.7% (95% CI 69.5-76.3). In comparison, in studies where no subjects had multiple knees revised, the proportion of E/G was 82.6% (95% CI 79.1-86.3) $p < 0.05$).

Patients undergoing single TKAR had better postoperative scores than those receiving multiple TKAR. Additionally, the percentage of subjects reporting E/G results increased over followup duration until approximately 60 months (Figure 4). There was a difference in the proportion of subjects reporting an E/G outcome between articles in which a higher percentage of patients with infection as the proximate cause for revision as compared to those in which fewer patients were infected ($p < 0.05$). Series reporting outcomes from uninfected patient had a higher proportion of subjects with E/G outcomes compared to subjects from “infected series” (percent E/G uninfected = 78.5%; 95% CI 74.7%-82.3%; % E/G infected = 67.5%; 95% CI 61.5%-73.4%).

What is the complication rate following TKAR?

The results from our systematic review (as well as a previous review by Callahan and colleagues) demonstrate that the revision rate after about four years of primary TKA is approximately 3-4%. Forty-four of 46 (95.7%) cohorts reported complication data on 1,683 subjects who incurred 443 complications (26.3%). It was not possible to determine which or how many complications occurred in any given patient or patient subset. There were a total of 217 knee complications in 1,683 subjects necessitating re-revision (12.9%). Using a broad definition of complications, Callahan et al. found a 30% overall complication rate and a 7.2% revision rate in 18 bicompartmental knee arthroplasty reports with 884 enrolled patients and an 18.5% overall complication rate and a 9.2% revision rate in 46 unicompartmental knee arthroplasty (UKA) reports with 2,391 enrolled patients.[38]

Updated findings of the TKAR report

We updated the previous review by Saleh et al. to include articles published from 2000 through June 2003. An additional 27 articles were identified of which 14 (n = 638 knees) met inclusion criteria. They are summarized in Table 23. The updated findings do not alter the conclusions of the original report just described. They do add additional information related to various types of revision knee systems or surgical procedures. Descriptions of the individual reports are provided below.

Two articles assessed the effectiveness of polyethylene exchange as an isolated revision procedure. Brooks et al. assessed the effectiveness of isolated polyethylene exchange in revision TKA for tibiofemoral instability.[39] Based on 14 cases, the authors found the procedure to be an effective, low morbidity treatment to treat one type of prosthetic knee instability. Achievement of a successful result with this technique occurs with competent balanced ligaments. Patients with incompetent ligaments or with a significant flexion extension mismatch are less likely to achieve a successful result. Babis et al assessed the results of isolated tibial insert exchange during TKAR in 55 patients (n=56 TKAR).[40] The study demonstrated that isolated tibial insert exchange led to an unacceptably high early failure rate. The authors recommended that orthopedists proceed with caution in all cases in which isolated tibial insert exchange was being considered.

Miller et al. retrospectively compared UKA revision to TKA with a group of primary TKA.[41] The study revealed that UKA revisions had a higher incidence of wound infection and less improvement in Knee Society pain and function scores compared to primary TKA. In addition, the study suggested that posterior cruciate ligament (PCL) substituting designs were superior to posterior cruciate ligament sparing designs and had Knee Society pain and function scores that were comparable to the primary TKA group.

Christensen et al evaluated improvements in range of motion and Knee Society pain and function scores following revision TKA in 11 patients who presented with pain and limited range of motion.[42] The study results indicated that range of motion and Knee Society scores improved significantly following revision TKA.

Gofton et al evaluated the midterm results of revision knee procedures using a modular all-cobalt chrome stem in 97 TKARs.[43] The study compared posterior stabilized and varus/valgus constrained articular inserts. There were no differences in post-operative KS scores between the posterior stabilized and the varus/valgus constrained groups.

Nazarian et al retrospectively reviewed the results of TKAR using the Insall-Burstein constrained condylar knee implant used with and without intrameduallary stems.[44] The study found no significant difference in Knee Society scores between the two above noted groups.

Three articles focused on the use of bone grafting in revision TKA. Lonner et al evaluated the short-term results of impaction cancellous allografting and molded wire mesh in the management of massive uncontained defects about the knee in revision TKA.[45] The authors found it to be an effective method of managing bone defects. Benjamin et al compared the KS scores of patients with and without morselized bone grafting used for tibial or femoral defects in patients undergoing revision TKA with one revision knee system.[46] The authors found no difference in preoperative or post operative knee scores between the two groups. They concluded that morselized bone grafting is a reasonable alternative in the reconstruction of osseous defects in patients undergoing revision TKA. Hanssen described a surgical technique for restoration of

patellar bone stock in patients with severe patellar bone loss undergoing revision TKA.[47] KS pain and function scores were improved in short to mid-term clinical results.

Two articles evaluated revision/resection of the patellar component in TKAR. Leopold et al followed 40 knees with a Miller Galante I prosthesis that underwent isolated patellar revision of TKA with or without lateral retinacular release.[48] After a mean followup of 62 months isolated patellar revision with or without lateral retinacular release was associated with an "unacceptably high rate of reoperation and a relatively low rate of success"; the gain in mean HSS score was only from 72 to 87. Parvizi et al undertook a study to evaluate the clinical and functional results of patellar component resection arthroplasty with or without revision of the tibial or femoral components for severely compromised patella for which insertion of another patellar component was not an option.[49] The study demonstrated that patients treated with isolated patellar component resection arthroplasty were more likely to require reoperation and experience persistent pain when compared with patients who had concomitant revision of the tibial and femoral components.

Werle et al. assessed the use of large (30mm) metal distal femoral augments to compensate for severe structural femoral metaphyseal bone loss in revision TKA.[50] The study found the technique to be "acceptable" as there were improvements in Hospital for Special Surgery scores, Knee Society scores and ROM upon compilation of intermediate term results (37 months).

Two articles assessed the use of a hinged prosthesis in revision TKA. Springer et al reviewed 69 knees treated with Kinematic Rotating Hinged Knee prosthesis for complex primary TKA and salvage revision TKA.[51] Based on the study results, the authors recommended that KRH arthroplasty be reserved for final salvage option of the treatment options available when performing complex primary and salvage revision knee arthroplasties. Jones et al undertook a retrospective study to delineate the success of S-ROM mobile bearing hinge total knee prosthesis for revision TKA.[26] The indication for TKA included severe instability and bone loss. The authors concluded that a satisfactory result can be achieved when using S-ROM mobile bearing hinge total knee prosthesis for the above indications.