ROUNDUP360

Knee

Cruciate substituting versus retaining knee replacement

It is sometimes difficult as a surgeon to see what is important in patient outcomes; we certainly strive to establish the outcomes of the bits we do: surgery. This approach, however, forgets that all surgical interventions are complex and that the effect of the surgery is small and often lost in the rest of the care package. One area with which knee surgeons in particular have struggled is that of posterior-stabilised or cruciate retaining knees. There are differing philosophies in primary joint arthroplasty and sound arguments made by sage surgeons in support of both approaches in straightforward varus OA of the knee. Despite the high levels of interest, there has been no conclusive answer as to how these two different philosophies of total knee replacement (TKR) fare in longer-term follow-up studies. Surgeons in **Ontario (Canada)** have reported their own retrospective cohort study comparing the cruciate retaining (CR) and cruciate substituting (CS) versions of the same Genesis 2 TKR (Smith and Nephew, Andover, Massachusetts).[1] The research team followed patients up to a minimum of ten years. This retrospective comparative cohort series reports the outcomes of 422 patients (143 CR and 271 CS prostheses). As would perhaps be expected given the results from the larger european registries, the authors could not demonstrate a difference in overall survival. However, unlike the major registries, these authors also had access to clinical scores and range of motion measurements. In these outcomes those patients who received a CS prosthesis outperformed their CR comparisons with respect to knee range of movement and clinical scores. KSCRS function and total score (57 vs 70; 149 vs 163) were significantly better in the CS group, as were the WOMAC scores (64.9 vs 73.3). The authors acknowledge that there will of course be patient selection bias by the nature of the study design. However, most surgeons would suggest the use of CS prostheses in more complex knees or those in which there is significant pre-operative deformity. This study, to our minds at *360*, demonstrates that certainly in the Genesis 2 system at least, CS knees function better at ten years than CR. With the advent of clinical outcome scores in joint registries it may be possible to demonstrate such results on a larger scale when PROMs results are measured over a similar time period.

What's behind the psychology of anterior cruciate ligament (ACL) reconstruction?

There are papers in almost every diagnosis to support the contention that patients with poorer psychological health worsen after surgery. However, we can't help wondering if there is a little bit of circular reinforcement in this argument. After all, living in pain will make you depressed, given time, and patients with long-term pain and disability have a poorer long-term outcome. There has been a large body of work examining the psychology of total joint arthroplasty regarding investigation of soft-tissue diagnoses (usually less painful), and these diagnoses make for interesting comparison. A review team in **Ohio (USA)**[2] undertook a systematic review to assemble the existing evidence on the effects of psychology on patient outcomes in soft-tissue knee surgery. The review team used the familiar systematic review methodology searching a range of online medical indices; 1633 studies were identified as potential for inclusion, but just eight studies were prospective studies with baseline and follow-up psychological and clinical outcome measures assessed. The study population included over 600 patients with a median follow-up of nine months, making this a reasonable population from which to draw inferences. The study team established that in terms of pre-operative personality type, patients who were optimistic and self-motivated were much more likely to do well, with better compliance with rehabilitation, return to sport and ultimately PROMS measures. Patients' environmental surroundings are also seen to affect their outcomes, with social support positively impacting and social stress negatively impacting on outcomes and rehabilitation compliance.
In terms of mental state, perhaps surprisingly kinesiophobia and pain catastrophising are not associated with an effect, adverse or otherwise, on outcomes. Given the significant effect that patients' outlook, motivation and social circumstances have on their outcomes, it seems to us at *360* that both patient selection and post-operative care should take these into account. It's not just about choosing winners; taking these factors into consideration can 'make' winners.

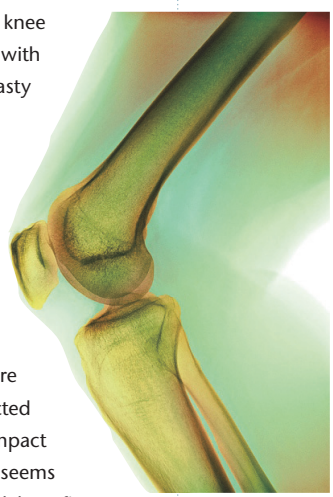
Is there a difference in total knee arthroplasty risk of revision in highly crosslinked versus conventional polyethylene?

In the age of bundled payments and cost reduction, we must ask ourselves if each new technology introduced to the market is beneficial for our patients, and if the benefits at a patient level outweigh the costs at a societal level. When highly crosslinked polyethylene technologies were introduced, the intention was that through cross-linkage of polyethylene chains the wear characteristics would improve. There is some evidence that, particularly for THA, the reduction in volumetric (but not necessary particulate) wear has been associated with improved survival and in some papers dramatic reductions in osteolysis rates. This along with other technologies has gone some way towards solving the important problem of longevity in THA; as patients have longer lifespans, so must their arthroplasties. However, polyethylene wear in TKA is not a common reason for revision, and hence the benefits traditionally associated with highly crosslinked polyethylene (and derived from hip-related data) should perhaps

not be used to support its use in TKA where the biomechanics and failure mechanisms are vastly different from that in THA. Researchers at Kaiser Permanente in **Oakland (USA)**[3] therefore set out to undertake a large population study with the aim of establishing if conventional polyethylene has a higher risk of revision compared with highly crosslinked polyethylene, specifically in TKA. The research team used data collated as part of the Kaiser Permanente Total Joint Replacement Registry which now includes over 77 000 knee arthroplasties performed over the ten years. The research team identified 11 047 patients with highly crosslinked polyethylene bearings representing 14% of the study population, and analysis was undertaken by arthroplasty design and bearing implant type. As is the nature of this type of study, the population is heterogenous and there are selection biases inherent on implant selection and surgical procedure performed. The research team were able to report their outcomes to five-year follow-up and undertook a fairly sophisticated statistical adjustment for potential confounders, including differing implant types. The headline results for this study were that there were no differences in risk of all-cause revision (2.7% vs 3.1% crosslinked-poly) at five years. There were similarly no differences within implant types. These results demonstrate fairly conclusively that in two different TKA implants (NextGen and P.F.C.Sigma), aseptic and septic revision rates were no different between polyethylene types after five years. Given the increased costs associated with crosslinked polyethylene components and the lack of any evidence in a large series to suggest improved outcomes, the cheaper standard polyethylene option seems better all round.

Unicompartmental knee arthroplasty: is age the missing variable?

There is nothing that divides knee arthroplasty surgeons like the unicompartmental knee. Proponents will wax lyrical about improved functional outcomes, shorter hospital stays and increased satisfaction levels, while these arguments are countered with higher revision and complication rates. Like so much in surgery, however, the devil is in the detail. There have been large numbers of studies conducted with the intention of comparing almost every imaginable facet of unicompartmental knee arthroplasty (UKA) with total knee arthroplasty (TKA), including studies on patient satisfaction, outcomes, revision rates, complications and outcomes of revision. On the other hand, there are few studies conducted on the economic impact of UKA. It certainly seems possible that the risk:benefit of the unicompartmental knee may change with age. Researchers in **New York (USA)**[4] set out to see if the health economic arguments were at all affected by the patient's age. In a slightly unusual take on study design, the research team from the Hospital for Special Surgery based their study around a Markov analytic model designed to compare UKA with TKA. Their paper calculated the lifetime cost of the procedure, the quality-adjusted life years and incremental costs of performing each operation on patients aged between 45 and 85 in ten-year increments. The study itself didn't generate any new data but utilised previously published survivorship data from the Swedish Arthroplasty Register, transition probabilities from other published data and health economic data from the Health Care Cost Utilisation Project. Within the constraints of using previously published data, the authors estimated a 'break-even' point of over 65 years of age. Under 65 years there is an ICER of $63 000/QALY in favour of TKR at 55 years, and $30 300/QALY at 45 years. Using a UKA universally in all patients over the age of 65 would – according to the authors' model – give a lifetime societal saving in the US of between $56 and $336 million in 2015, rising to between $84 and $544 million by 2020. It would certainly seem that within the constraints of the study, universal use of the UKA in patients over 65 years old is an economically attractive option. This seems to closely support the Kozinn and Scott criteria[5] for performing cemented UKA in a patient population over 60 years old. It would seem sensible that surgeons who perform UKA should take patient age into consideration when making decisions on surgery. There is, however, slightly more to this story. While the results are clearly valid in these cohorts of patients, they are based on a combination of registry data and case series data – clearly not giving a like-for-like comparison; randomised study data to include in the Markov model would be needed for that.



Satisfaction rates following total knee arthroplasty

It is notoriously difficult to please patients with arthritis of the knee needing arthroplasty. While reported patient satisfaction after total hip arthroplasty ranges from 85% to 92% in literature, satisfaction after total knee arthroplasty (TKA) has been consistently reported lower. The inconsistency in results and a consistent reporting of poorer outcomes in knee arthroplasty have resulted in the publication of a number of studies with the aim of determining what contributes to satisfaction after TKA, and who is likely to benefit most. Researchers at the Rubin Institute for Advanced Orthopedics in **Baltimore (USA)**[6] designed a prospective longitudinal study of primary total knee arthroplasties from surgery to five years of follow-up. The research team collated the SF-36 physical and mental components and then explored the effects of demographics and comorbidities on outcomes following TKA. The results of this study suggest that TKA patients can expect to physically improve until one year after surgery, and then plateau, while mental state worsens in the first six weeks, then improves. A number of demographic factors including younger age, higher body mass index, smoking, arthritis in multiple joints, and immunologic disease all resulted in patients reporting poorer physical scores, while males had higher physical scores than women. Hypertension, diabetes, neurological disease, gastrointestinal disease, and psychiatric disease all resulted in poorer mental component scores after TKA. Patients with these parameters should certainly be considered when counselling patients and to temper expectations. This study identifies a number of poor prognostic factors for total knee arthroplasty and unusually looks at the temporal relationship between outcomes, prognostic factors and mental and physical functions. Somewhat frustratingly, however, as a scientific community we are still at a loss to explain why patients have poor satisfaction levels following knee arthroplasty, despite multiple studies.

Is knee alignment dynamic?

Historically, the goal of total knee arthroplasty (TKA) has been to achieve a neutral limb alignment, allowing for best biomechanical wear of the components. There things lay for many years, however, there has been a recent explosion in interest in knee biomechanics. Recent studies have nicely illustrated a dynamic alignment variable based on position, degree of weight bearing and gender. Despite advances in

computer navigation and patient-specific instrumentation, there is still a cohort of patients that remain unsatisfied following TKA which may well be in part attributed to limb alignment. Various studies have reported on the variation of limb alignment between genders and different positions, however, many of these studies report on patients with OA and after TKA. Without accurately assessing 'baseline' biomechanics it is somewhat farcical to consider a complete reimagining of the whole concept surrounding knee replacement. Researchers in **Glasgow (UK)**[7] set up this prospective study of 132 healthy volunteers (264 knees) from six different centres with the aim of more accurately envisioning knee biomechanics *in vivo*. In each patient the femorotibial mechanical angle (FTMA) was measured using the Orthopilot navigation system by a single surgeon in differing positions of load and flexion. The mean supine alignment was a varus angle of 1.2° but significant changes were seen with posture. On standing, the overall alignment shifted to 3.4° varus and differs significantly between males and females ($p = 0.008$). This study demonstrated that there is a wide variation in FTMA, even among healthy volunteers, and even when allowing for limitations such as the use of skin markers rather than bony attachments. The current goal of TKA is to restore neutral limb alignment, thereby allowing for optimal wear of the prosthesis, however, based on this study, the majority of normal people do not have neutral alignment, and intra-operative neutral alignment may translate to varus alignment in weight bearing. This does beg a number of key questions: are patient satisfaction issues associated with failure to restore natural biomechnics? If so, how does one establish what biomechanics were prior to development of osteoarthritis? How would this be best accomodated for in implant design?

Unicompartmental knee arthroplasty: cemented or cementless?

Unicompartmental knee arthroplasty (UKA) offers an alternative to total knee replacement for patients with isolated unicompartmental disease and normal biomechanics. The resurfacing procedure is more sucessful on the medial side, but implants exist for both medial and lateral compartment. Although there are some concerns over survival, there is good evidence that UKA offers faster recovery and better functional outcome compared with total knee arthroplasty (TKA), however, the risk of revision is greater. The most common reason for revision is due to aseptic loosening and despite the availability of both cemented and uncemented fixations there is little comparative data between the two. Although here at *360* we are naturally suspicious of designing centre studies, this prospective randomised controlled trial from **Oxford (UK)**[8] is designed to establish the best fixation of the Oxford UKA and adds a lot to current understanding of fixation in the UKA. In a well-controlled prospective randomised trial of 43 patients, implant fixation (but not design) was randomised to receive either a cementless or cemented Oxford UKA. Outcomes were assessed with RSA analysis, and patients were followed for two years post-operatively. In the femur there was migration of both component types (0.16 mm cemented vs 0.24 mm cementless) at six months which was then stable to final follow-up at two years. In the tibial component, things were slightly different, with the cemented components tipping into a mean varus of 0.29° at one year and then stabilising, where the cementless components subsided to a mean of 0.34 mm by two years. There was no significant difference in mean Oxford Knee Score between fixation groups. While the authors are quick to acknowledge that a large clinical study is necessary, they also suggest that cementless Oxford UKA is similar to a cemented Oxford UKA. If these components are as good in the short term it will be interesting to see a longer follow-up. Cementless fixation offers the tantalising option of potentially lower long-term loosening rates.

Can revision knee services pay?

In recent years, the number of TKAs has increased globally, and with patients living longer with higher functional demands the resulting revision burden is not insignificant. Revision TKAs are difficult, with increased risks, complication rates, hospital costs and length of stay. There have been papers predicting a health economic crisis for healthcare providers. The authors of this study set out to establish if, in the current healthcare climate in the UK, hospitals are able to cost-effectively provide care for patients requiring revision knee surgery. In this retrospective review researchers from **London (UK)**[9] compared revision surgery for infection with those for aseptic causes in a large series of 169 consecutive revision TKAs performed at a single centre between 2005 and 2012. The study population consisted of 45 revisions for infection and 123 for aseptic causes. Revision surgery for infection was associated with a greater mean length of stay compared with aseptic cases (21.49 vs 9.56 days) and the mean cost was more than three times that of aseptic cases (£30 011 vs £9655). While revision TKA surgery has been increasing over the years, the current NHS reimbursements are much lower than the cost of performing the surgery, thus centres are losing money on these operations, especially for infected cases. In a nationalised healthcare system that is trying to encourage 'free market'-type economics, we wonder here at *360* how long revision surgery will be encouraged in institutions that are effectively paying to do it!

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