

Perfect match knee surgery

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The early results of this exciting new technology are very promising. Total knee replacement is probably the only operation that has been shown to be cost effective for the community. It restores function to patients, reducing their reliance on other people and therefore reduces the burden on society.

Six months after joint replacement, significant improvements are seen in global health and in functional status.¹



Currently it has a better than 95% success rate, with most implants lasting up to 15 years.

Traditional surgery

Knee replacement has been around since the 1970s. Unfortunately the improvements in cutting guides (making them more accurate and easier to use) have not removed the need to instrument the patient's intramedullary space.

To judge alignment and rotation, metal rods are inserted into the patient's femoral canal (and sometimes tibia) during surgery.

This often results in fat embolism and blood loss and occasionally allows malrotation of the components.

Computer-assisted surgery

In the last five years or so, new technologies have been used to improve the alignment of the prosthesis during surgery. Tools to measure how accurately we are able to implant the prosthesis have improved tremendously and this should result in better outcomes for patients.

We know that if an implant is inserted more than three degrees away from its optimal position, it tends to wear out faster. Alignment of the prosthesis can be difficult to judge when using a small incision around the knee.

Computer-assisted surgery was a major breakthrough because for the first time it allowed a surgeon to measure the alignment of the implant during the operation.

Unfortunately, the computers do not help control the rotation of the implant and only partly reduce the likelihood of creating a fat embolism.

Also, they require extra instrumentation, lengthen surgical time and create extra potential complications for the patient (such as a fracture where the guide pins are inserted).

Hospitals also have to buy expensive computer systems and an extra person is

required at each operation to run the computer.

Patient-matched surgery

The next generation of computer-assisted surgery attempts to address these shortcomings.

Computer analysis is now used in the planning stage of the surgery rather than during the operation itself. This is called 'patient-matched instrumentation' and no longer requires the previous expensive computer systems in the operating theatres or staff to run them.

Slightly more effort is required from the surgeon before the operation but this is more than compensated for by having a quicker and easier operation.

What is patient-matched instrumentation?

The patient has an MRI and long leg x-ray of the knee. Data from these images is processed by an engineer, with input from the surgeon, and a physical model of the patient's bone is created. Measurements of the bone model are taken and the exact size of prosthesis to be implanted can be calculated before the surgery.

Based on these models and the surgeon's clinical examination of the patient, a cutting block is generated. This block guides the surgeon to cut off the exact amount of bone that will be replaced by the implant.

Cost Savings

Significantly less equipment needs to be sent to the hospital because the exact size of the prosthesis is known before the surgery.

Less instrumentation is required during the surgery and so sterilisation and courier costs are reduced. The blocks are shipped sterile for use during the operation.

Advantages during the surgery

During the surgery a standard (or slightly smaller) approach is undertaken to the knee.

The block 'locks into place' on the femur in the exact position planned prior to the surgery.

Since the block can only fit correctly in one position, less exposure of the bone is required than that required for traditional surgery. This ensures the alignment and rotation are correct with far less tissue trauma.

Traditionally, six blocks were used to check alignment and rotation but using the femoral cutting block eliminates the need to perform these steps. The surgery is quicker and reduces the chance of a fat embolism by eliminating instrumentation of the femoral canal.

This reduces blood loss and surgical time, which should lead to faster recovery and less pain. The surgeon is assured of good alignment and rotation and the patient has a shorter anaesthetic which also improves outcomes.

Benefits to the patient include:

- Less time in surgery (shorter anaesthetic)
- Reduced chance of a fat embolism
- Reduced blood loss
- Perfect alignment and rotation
- Potentially a faster healing time.

CONCLUSION

The early results of patient-matched total knee replacement surgery are extremely promising. Those of us who have used the technique are convinced that it is a huge improvement over previous surgical methods.

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1. Arthritis Rheum. 1986 Aug;29(8):937-43 - Cost-effectiveness of total joint arthroplasty in osteoarthritis; Liang MH, Cullen KE, Larson MG, Thompson MS, Schwartz JA, Fossel AH, Roberts WN, Sledge CB.