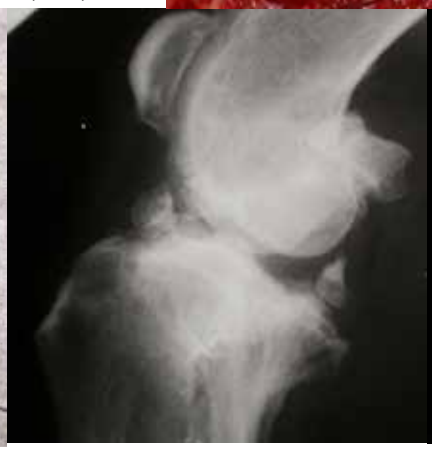
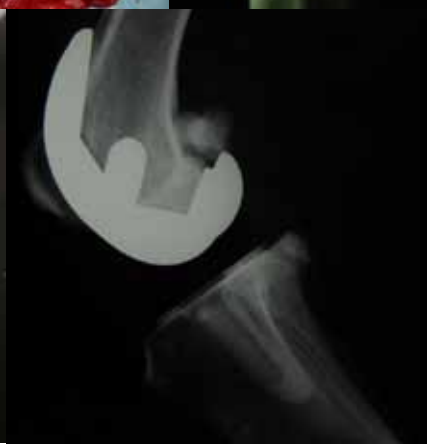
Animal Surgery Centre

Total Knee Replacement

This much needed procedure is now clinically available in Australia for canine patients and offers pain-free stable knee function in dogs suffering from medically-unresolved chronic osteoarthritis (OA).





Patient Selection:

1) Failed extracapsular surgery (DeAngelis)
2) Chronic ACL deficient knees
3) Complex medial patellar luxation
4) Stifle osteochondrosis (OCD)
5) Trauma - knee luxation, articular fracture

Contraindications:

1) Neoplasia - osseous or soft tissue
2) Chronic joint infection
3) Insufficient patient size (<15kg)
4) Owner malcompliance
5) Pathology of patellar tendon

History:

Knee replacement surgery (TKR) started in the late 1950's using a hinge style of constrained prosthesis. Loosening at the implant-bone interface limited success. In 1968 a Canadian surgeon, from Sir John Charnley's hip centre in the UK, developed the first metal-on-plastic system which was cemented in place. Currently, over 600,000 patients have TKR annually worldwide. The clinical success rates are high with >95% of patients functioning well 15 years postop. In veterinary medicine, canine and ovine patients have been used in the development of human prostheses for many years as a research model. In 2007, Dr. Bill Liska from Gulf Coast Veterinary Specialists in Texas, in conjunction with BioMedtrix corporation, launched the first clinically available system for dogs. The system is unconstrained with two components (cementless femoral & cem

The first four clinical total knee replacements in Australia were performed by Dr. Chris Preston and Dr. David Lidbetter along with a human knee replacement surgeon.



Background training:

Human knee orthopaedic surgeons perform knee arthroscopy (primarily meniscectomy), ACL reconstructions and total knee replacements on a daily basis. Chris has a good friend who is a specialist knee surgeon in Melbourne. The first step was to undertake specific training in human hospitals to gain familiarity with the equipment, implants, surgical technique and postoperative patient management. The human and canine knee anatomy is similar enough that the same surgical prinicples can be extrapolated to the dog. Having access to a human orthopaedic surgeon with a willingness to help has been critical to the early sucess in dogs. Dr. Chris Preston (Melbourne) and Dr. David Lidbetter (Sydney) travelled to Texas in early 2008 and were trained in the technique by the father of canine joint replacements, Dr. Bill Liska. Dr. Liska is world renowned for his contributions to developing and improving hip, elbow and knee replacements in dogs. Chris and Dave have progressed from cadavers to clinical cases and have operated the first series of cases together in both Melbourne and Sydney.

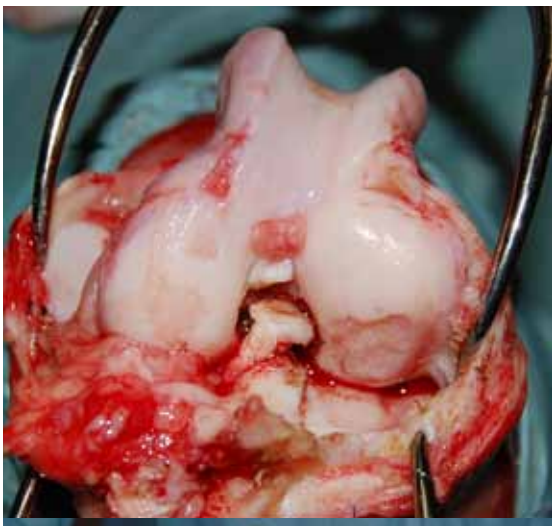
Clinical decision making:

Dogs that have extracapsular fabellotibial prostheses implanted can have a poor outcome. This can be due to instability, untreated meniscal pathology, infection or osteoarthritis. Here you can see images from a dog that had a DeAngelis surgery and is still limping. The metal tube is a crimping device to secure the nylon prosthesis. Arthrocentesis and synovial fluid culture can be perform if infection is suspected. Stifle arthroscopy can help by assessing the ACL and meniscal integrity. Arthroscopic meniscectomy can be performed. TPLO can salvage knees with limited osteoarthritis.




Templates and trial implants:

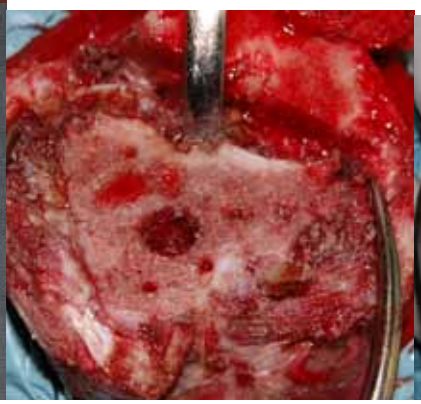
A series of acetate overlays are available to select the most appropriate femoral and tibial implants for each case. There are seven incremental femoral sizes. The tibial component comes in five footprints but each has three different thicknesses. The key to selecting implants is to achieve a stable joint in both flexion and extension and eliminate soft tissue restrictions due to the development of periarticular fibrosis. During surgery, the surgeon can use 'trial' implants (blue plastic) to check the range of motion and stability prior to implanting the definitive implants. It is imperative to gain sufficient exposure during surgery to understand the boundaries of the distal femoral and proximal tibial bone stock. This will minimise the risk of collateral ligament damage when making bone cuts and reduce the incidence of undersizing of implants. Here we see adequate exposure of the entire tibial plateau using bone levers to subluxate the tibia.



Surgical technique:

A standard craniolateral parapatellar arthrotomy is performed. There is a bursa at the insertion of the patellar tendon onto the tibial tuberosity which is opened. The patella is medially luxated. The procedure in dogs fails to preserve the posterior cruciate ligament. Remnants of the ACL, the PCL, both meniscii and the infrapatellar fat pad are excised *en bloc*. In this case we can see cartilage pathology secondary to a lateral femoral condylar osteochondrosis lesion (OCD) years prior to TKR. Marked periarticular fibrosis develops in most knees and this can be dramatic medially (buttress formation). Releasing this contracted scar tissue improves joint mobility and exposure to the bone surfaces prior to performing the osteotomies.

An extramedullary alignment jig has been developed to assist the surgeon in making the tibial plateau cut in the correct orientation. The jig is adjustable and is temporarily attached to the patient's distal limb. You can see that the jig is very similar to that used in human surgery (see previous page). The jig allows the surgeon to control the height of the cut as well as the mediolateral and craniocaudal slopes. A low cut is required to completely expose the entire tibial plateau as well as remove the caudal aspect of the tibial condyles. This allows use of a larger tibial implant as well as allowing it to be positioned more caudally. An oscillating saw passing through a slot in the jig is used to cut the proximal tibia. Care is taken to protect the collateral ligaments during cutting. Peroxide can be used to dry the bone prior to application of cement and fixation of the polyethylene implant.



Surgical technique:

The femoral cutting jig is secured onto the distal femur using divergent pins. The position of the jig relative to the three orthogonal axes is critical to attaining correct femoral component alignment.

An oscillating saw is used to make four cuts. All articular cartilage is removed. A 7mm diameter hole is also greated to accept a post on the femoral prosthesis.

The anterior and posterior cuts are 10 degrees divergent. The femoral implant has beads on its undersurface. The implant is impacted using an attached handle and mallet. THe porous coating of the undersurface grips the exposed cancellous bone. New bone ingrowth will occur in 6-8 weeks via a process termed osseointegration.

Canine vs. human TKR:

Similar approach, jigs, cuts, implants and closure. Different draping and patellar resurfacing in man.

Ruby, a 7 yo. female Golder Retriever with chronic DJD due to ACL insufficiency, was the first dog in Australia to have a TKR - **Animal Surgery Centre** in May 2008

Analgesia:

Joint replacements require aggressive intra- and postop. analgesia. All dogs receive epidural morphine, bupivicaine into the synovium, parenteral morphine q.2-4 hourly for 24 hours, pre-emptive NSAIDs and oral NSAIDs for 7-10 days.

Physical therapy at home:

Passive knee extension exercises are required in dogs that fail to use the limb well early postop.