REFERENCES


Cannulok®

Conceived in association with Mr Andrew Quaile FRCS and further developments based upon the clinical work conducted in collaboration with Mr Godfrey C Charnley FRCS, and other valued customers.

Cannulok®Plus

Further developed in collaboration with Mr David Ward FRCS and other valued customers

Orthodynamics remains totally committed to the development of Solutions in Orthopaedics

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Orthodynamics - A Summit Medical Group Company
A unique combination of modular revision hip prosthesis with locking intramedullary nail

- Revision hip system for a wide range of clinical indications
- Cannulated to assist closed fracture reduction
- Distal locking for improved fixation
- Anterior bow reduces risk of anterior perforation and maintains stem closer to the centre of the canal
- Anatomical design, antverted for preferred use in the intact femur, available in 240, 300 and 360mm lengths
- Available in four stem diameters 11, 13, 15 and 17mm
- Fully hydroxyapatite coated for enhanced cementless fixation, particularly where the proximal femur is deficient
- Available with standard or 45mm offset
- Increased proximal body options enabling greater proximal fill
- Modular head choice with options to maximise leg length adjustments or retention of existing acetabular component
- Comprehensive, updated instrumentation including distal targeting jigs
Closed procedure with standard guide wire technique helps preservation of blood supply with improved conditions for fracture healing.

Smaller exposure leads to reduced blood loss and reduced risk of infection.

Reduced soft tissue damage enables earlier mobilisation.

Fixation of the distal fragment controls rotation and shortening with earlier and more secure ambulation.

Multiple revision operations inevitably lead to the loss of proximal bone stock, particularly when associated with cement removal. The Cannulok®Plus solution allows effective distal fixation allowing recovery of proximal bone stock over time. Apposition fit at the Isthmus with a fully HA coated prosthesis provides an elegant solution to this problem.

Periprosthetic femoral fractures below rigid metal hip prostheses are an increasing problem. Treatment with a conventional long stem prosthesis is less than satisfactory, due to the difficulties in guiding the stem through the fracture site during insertion and the problems of stabilising the distal femur without introducing bone cement around the fracture which compromises bony union.

Primary proximal femoral fractures may present similar problems when treated with a conventional hip prosthesis or cause concern over survival of the femoral head when treated by intramedullary nailing or internal fixation alone.

The operative technique is simplified by design features which give the surgeon a degree of comfort in this difficult surgical area:

- Cannulated reamers prepare the femur for the intended prosthesis.
- Cannulated rasps ensure proximal profiling for press fit.
- Cannulated trials allow impaction grafting to be considered.
- Modular head components allow trial reduction to assess stability.
- Distal targeting device facilitates placement of up to three locking screws (use of an image intensifier should be considered especially when implanting longer, slimmer stems).
- Distal locking screws have been designed specifically for the Cannulok®Plus implant and have a shallow thread profile with self tapping flutes. This configuration achieves a balance of strength in both screws and femoral stem and eases insertion allowing for minor variations in alignment.
CLINICAL INDICATIONS

- Management of the grossly deficient proximal femur as a result of osteolysis
- Reinforcement of the femur where bone stock is depleted as a result of previous surgery
- Periprosthetic fractures around both total hip and hemiarthroplasty implants
- Femoral fractures and fractures around the trochanteric region complicated by metastatic bone disease
- Intraoperative fracture of the femur during hip arthroplasty

Note: Use of an anatomical prosthesis is particularly indicated in situations where the femur remains intact and there would otherwise be a risk of perforating the anterior distal femoral cortex with any straight component.

PRE-OPERATIVE PLANNING

The use of templates is recommended to establish the optimum size of prosthesis. The largest possible diameter implant should be used; this typically correlates to 1 mm less than the final femoral reamer. Implant length should be selected to allow adequate bridging of the most distal defect. It is recommended that distal locking holes should be a minimum of 40 mm below any femoral defect to avoid excessive stress concentration. Due to variations in patient anatomy, the bow of longer length femoral stems should be checked on a medial-lateral X-ray.

Fully HA coated stems are now offered in a choice of 240, 300 and 360 mm lengths with standard or 45 mm head offset. The shorter stem may be more suited to routine revision, where the femur is not fractured but reinforcement of the proximal region only is required.

The existing femoral head diameter must be specified if the surgeon intends to retain the original acetabular component, and the preferred head diameter advised where revision of both components is likely to occur.

Multiple neck length adjustments are possible for 22.25, 26, 28 and 32 mm metal heads. 28 and 36 mm ceramic head options ranging from 40-58 mm may be specified.

An image intensifier should be to hand, enabling:
1. The appropriate positioning of the reaming guide wire
2. Assistance with distal locking
3. Correct alignment

It is important that the surgeon is familiar with closed intramedullary nailing techniques. The majority of cases involve the presence of a fracture around or below an implant or femoral deficiency requiring distal fixation and the technique described will reflect this.

POSITIONING

The patient is positioned on their side, on a radiolucent fracture table. The standard position used for total hip arthroplasty is eminently suitable. The patient is draped in the normal way incorporating any skeletal traction pins employed in the initial management as handles. The position of the image intensifier should be clarified with the radiographer at this stage.

INCISION

If appropriate, the old incision should be used. Alternatively, a standard lateral incision is recommended, the same as that used for total hip replacement.

APPROACH

Either a posterior or anterior type approach can be used. It is recommended however that the anterior approach be used to ease imaging.

A modified Hardinge approach appears to give excellent access. This requires splitting of the fascia lata and tensor fascia lata, dissection of the gluteus medius and minimus from the greater trochanter and opening of the hip capsule.

PREPARATION OF THE ACETABULUM

The Cannulok® Plus system can be used with a wide variety of head sizes including hemiarthroplasty heads. The decision can therefore be made as to the most appropriate procedure required for the acetabulum.

The size of the intended head is at the surgeon’s discretion. The 28 mm option allows up to 4 intraoperative neck length adjustments to maximise stability.

Should a cup already be in place, secure and undamaged, then the appropriate head to match the existing implant should be requested when booking.
The femur should now be lavaged thoroughly to remove all debris. A cannulated trial prosthesis is passed over the guide wire using the 8mm trial introducer. A trial reduction is then performed with a suitable trial stem and test head. At this stage, it is often useful to employ some means of prophylactic cerclage to stabilise the fracture prior to insertion of the definitive prosthesis. Leg length is checked, and a landmark selected on the trial prosthesis for reference to the actual implant.

JIG ASSEMBLY

Once a suitably sized trial has been selected, the scrubbed assistant should set up the distal locking jig on the definitive prosthesis, and adjust the jig to ensure perfect alignment with the distal locking holes. The intended prosthesis is removed from its sterile packaging within the sterile field. The distal locking jig which corresponds to the implant length is selected.

PREPARATION OF THE FEMUR

Image intensification is employed for preparation of the femur. For the anterior approach, the leg is swung over the table away from the surgeon. In the posterior approach, the leg is angled away from the lower leg on the table to provide visualisation. The X-ray picture is taken to check the fracture geometry and proximal femur. The original prosthesis is removed and any cement excavated proximally using dedicated revision instrumentation. A long drill may be employed to locate and drill through the centre of the proximal cement restrictor, taking care to image in multiple planes to ensure centralisation of the drill bit.

A reaming guide wire should be passed at this stage, checking its passage on X-ray and that it is resting centrally in the distal femur with the fracture site reduced.

Cannulated Orthodynamics reamers may be used to ream the femoral canal. For cementless fixation, over reaming by 1mm is recommended. This ensures optimal apposition of the HA coated implant to the host femur. If difficulty is experienced during trial or implant insertion, further reaming may be required.

Cannulated rasps are also an important consideration when optimising press fit of a HA coated prosthesis, and the appropriately sized rasp should always be selected to match the intended prosthesis. The proximal femur is then profiled with the cannulated rasp which passes over the guide wire. The correct amount of anteversion is controlled by the use of the rasp.

TRIAL REDUCTION

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The main body of the jig has a short spigot, which is inserted into the cannulation of the prosthesis. NOTE: occasionally the spigot needs lubricating with a ‘gelonet’ type proprietary product.

The 6mm distal locking jig handle passes through the jig and screws into the prosthesis securing the jig firmly in position. The jig must now be adjusted to match the definitive implant.

1. Slacken the distal, centre and proximal locking screws
2. Insert the 3-holed barrel into the distal section of the jig
3. Insert the 3 drill guides into the barrel and insert the 3 drill bits
4. On a flat and clean surface adjust the jig to allow the 3 drills to pass vertically through the distal locking holes in the implant
5. Tighten the locking screws in the following order: centre, proximal & distal ensuring that ALL drills pass smoothly through the stem after each adjustment
6. Remove drills and drill guides and set aside. Carefully unscrew the 6mm distal locking jig handle and place all components on a clean flat surface.
INTRODUCTION OF THE DEFINITIVE PROSTHESIS

Do not use the jig as a stem introducer as doing so will result in unreliable screw positioning.

Stem insertion must only be carried out with the prosthesis mounted on the 6mm implant introducer. Anteversion can be adjusted finally by means of the introducer. The fracture rotation is checked on image intensifier once again. The reduction can be corrected by rotation of the distal fragment by the surgeon’s assistant.

TRIAL REDUCTION AND ADJUSTMENT OF NECK AND LEG LENGTH

The surgeon has an extensive choice of femoral heads, both in terms of head diameter and neck length options. A trial reduction is carried out at this stage using the test heads provided and any adjustment for length established.

DISTAL LOCKING

Implant stability is usually achieved using the two most proximal screw holes. This also reduces stress concentration at the tip of the stem. A third distal screw hole is available should further fixation be required.

Distal locking can be achieved by two means -

1. By reattaching the distal locking jig.
   - A small incision followed by soft tissue deflection using mosquito forceps will allow the drill guides to appose the lateral cortex of the femur. It is important to secure the drill guides by tapping gently.
   - Once the drill guides are in position and secured, the middle hole is drilled.
   - This drill bit is left in situ by detaching it from the chuck. THIS PROVIDES CRITICAL EXTRA STABILISATION OF THE JIG for preparing the proximal screw hole.

2. Traditional means by free hand techniques.
   - Drill the proximal screw hole and remove the drill bit. NEVER REMOVE MORE THAN ONE DRILL BIT AT A TIME. Insert the depth gauge to identify the correct choice of self tapping distal locking screw and insert the screw.
   - Remove the central drill bit, insert the depth gauge to identify the correct choice of self tapping distal locking screw and insert the screw.
   - Additional fixation can be achieved by inserting the distal screw. Prepare and insert the screw using the method previously described.

Before the hip is reduced, ensure that the appropriate femoral head is impacted to securely fit on the prosthesis.

WOUND CLOSURE

This is at the discretion of the surgeon, but suction drainage is recommended for the femur.

POST OPERATIVE REGIME

After postoperative X-rays have been taken to confirm satisfactory placement of the Cannulok®Plus prosthesis, it is possible to mobilise the patient if the distal fixation is thought adequate. It is recognised that many patients to be treated with this technique will be unable to manage co-ordination of crutches or frames and partially weight bear. Otherwise it is advised that full weight bearing commence on the appearance of callus.

Where proximal/mid femoral bone quality is compromised, restricted weight bearing is advised until reasonable bone quality and support is restored.
A woman with seropositive rheumatoid arthritis underwent revision hip surgery to a long stem cemented implant following early aseptic loosening. 7 years later the patient sustained an atrumatic unstable periprosthetic fracture. The stem was revised to a fully HA coated implant, 2 months postoperatively, a second stable periprosthetic fracture was sustained and fixed with cable/plate fixation with use of autogenous iliac-crest bone graft. 2 years later, the patient presented with an infected non-union. All metalwork was removed leaving a grossly deficient proximal femur, ectatic in nature, with combined cavity and segmental bone loss and discontinuity mid-shaft. 16 months postoperative, reconstruction was performed.

Intraoperatively the Trident all poly constrained cemented acetabular component was fitted with a 15 / 300 mm Cannulok HA coated stem and locked distally.

At the 4 month review, the patient was showing excellent post operative pain relief but was slow to mobilise due to shoulder problems.

Courtesy of Mr. Jonathan Keenan FRCS
Consultant Orthopaedic Surgeon, Scarborough Hospital, East Yorkshire

This patient sustained a closed, mid-shaft femoral fracture amongst multiple other injuries. His femoral fracture was fixed with a locked intramedullary nail and he underwent exchange intramedullary nailing for non-union 21 months after fracture. The non-union persisted and he later developed symptomatic osteoarthritis of the ipsilateral hip.

At 33 months from initial injury a custom made, fully HA coated Cannulok-femoral stem was inserted across the non-union with a ceramic head and an uncemented cup. Autograft from reaming the femoral head and acetabulum was placed at the fracture site. Femoral union was achieved by 7 months and the hip arthroplasty functions well at 6 years.

Courtesy of Mr. C Andrews FRCS
Consultant Orthopaedic Surgeon, Derriford Hospital, Plymouth

This lady presented with a periprosthetic fracture of the right femur (Vancouver B1) following the implantation of a Charnley primary stem.

Initially, the fracture was fixed using Zimmer cable grip system and bone graft. This fixation failed.

The metalwork was removed and a trochanteric osteotomy performed. A Cannulok hydroxyapatite coated stem was implanted with strut graft.

The latest review was 3.5 years post surgery and the patient was able to mobilise independently using 1 stick, pain free.

Courtesy of Mr Jonathan Keenan FRCS
Consultant Orthopaedic Surgeon, Derriford Hospital, Plymouth

This patient has had a right cemented total hip replacement in 1985 and a left cemented total hip replacement in 1986. Both hips required revision due to aseptic loosening of the cemented femoral implants in 1991 and again cemented implants were used.

In 2004 the patient presented again with aseptic loosening of the implants on both sides. The second revision of right hip with an uncemented stem and acetabular constraint. Uneventful recovery but readmission with periprosthetic fracture dislocation 14 days after discharge. The femoral component was exchanged to the Cannulok system with distal locking with an uneventful recovery. A second revision of left hip with the Cannulok distal locking stem and a press fit acetabular cup in 2006.

Patient still plays golf with a single figure handicap.

Courtesy of Mr. LM Koch
Consultant Orthopaedic Surgeon, Dewsbury and District Hospital
Distal locking Screws

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CERAMIC FEMORAL HEADS (ZrO2)

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FEMORA L HEADS (CoCr)

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RECOMMENDATIONS TO CLINICIANS

The Cannulok® Plus prosthesis is one of the more common templates upon which many of our custom manufactured components are based. This often includes:

- Supplementary distal locking options
- Anterior screw holes
- Exaggerated anatomic bows
- Increased and intermediate stem lengths
- Variations to HA coatings

MATERIALS SPECIFICATION

The Cannulok® Plus system is manufactured in high strength forged Titanium (Ti-6Al-4V) for maximum fatigue strength.

CUSTOM PROSTHESSES

The Cannulok® revision system has been used successfully in a large number of patients since 1992. The number of stem failures experienced during this period has been extremely small (<0.06%).

Laboratory fatigue testing under simulated clinical conditions in accordance with International Standards suggests:

1) That even the smallest diameter implant is safe provided a moderate level of femoral support is achieved

2) That where proximal/mid femoral bone quality is compromised, restricted weight bearing is advised until reasonable bone quality and support is restored.

These recommendations are directed principally towards use of smaller diameter prostheses. It is recommended that the largest diameter stem should always be selected, consistent with patient anatomy and bone preservation.