X-change®

REVISION INSTRUMENTS
SYSTEM

OPERATIVE TECHNIQUE

-FEMUR AND ACETABULUM

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Fig. 1 - Templating

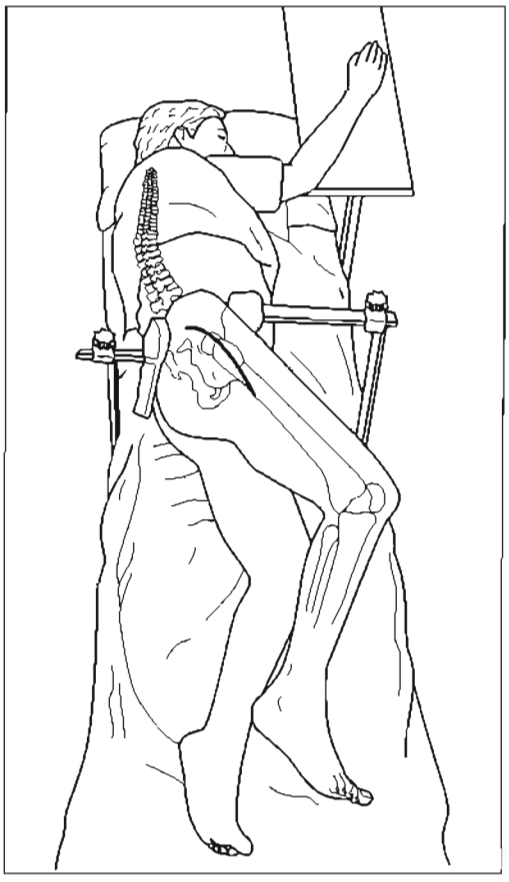

Fig. 2 - Rigid fixation of patient in lateral position

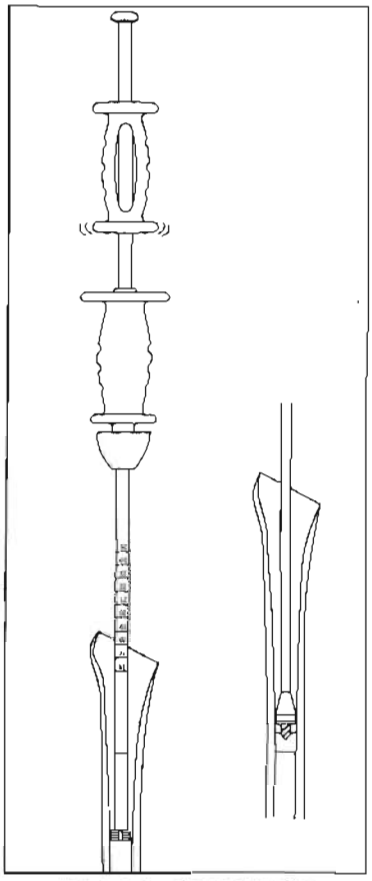

Fig. 3 & 4 - Distal occlusion of the femur

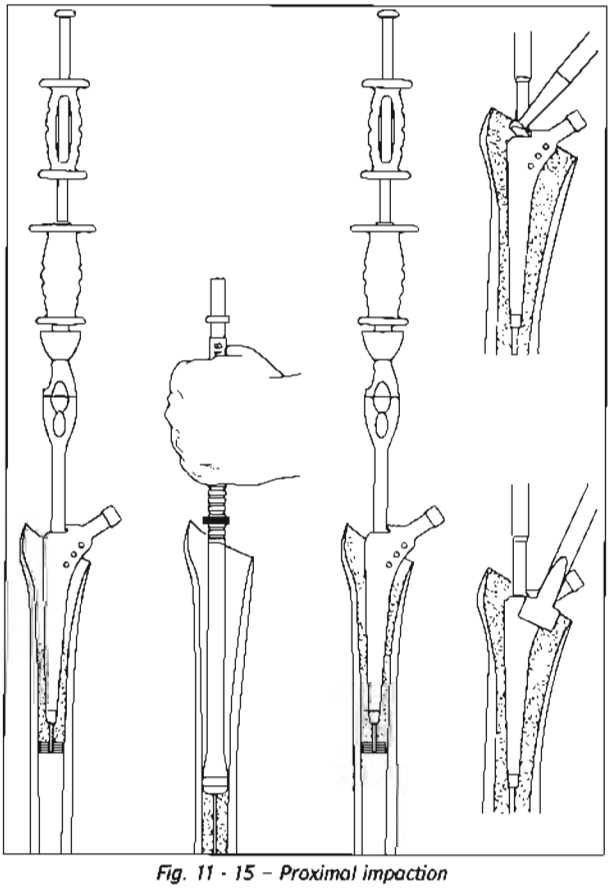

Fig. 11 - 15 - Proximal impaction

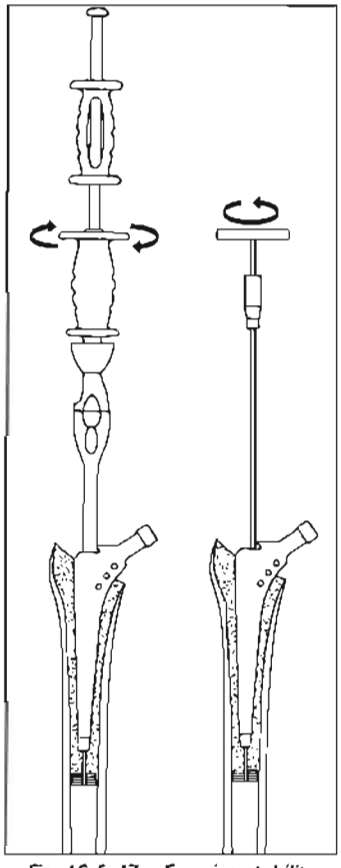

Fig. 16 & 17 - Ensuring stability of proximal impactor

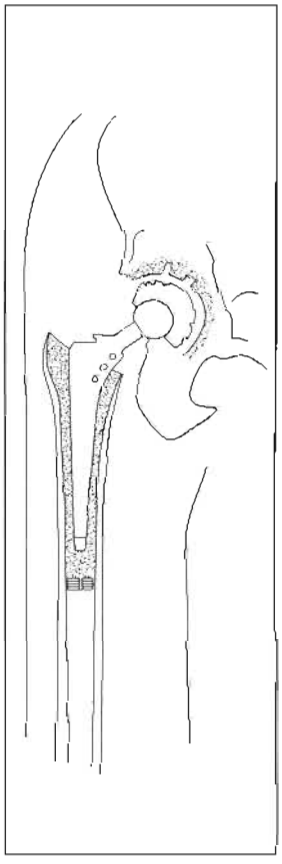

Fig. 18 - Trial reduction

TECHNIQUE HIGHLIGHTS

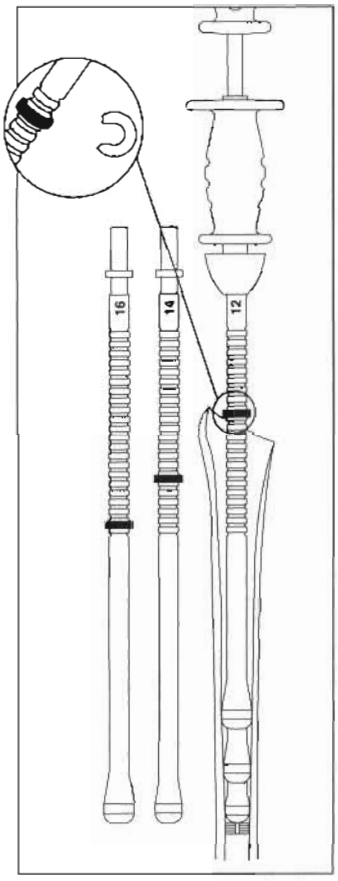

Fig. 5 & 6 – Sizing the distal impactors

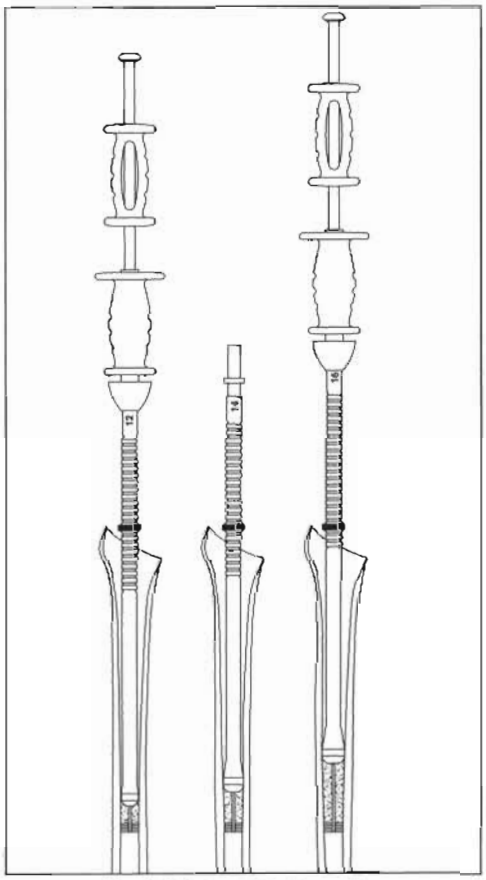

Fig. 7, 8 & 9 – Distal impaction

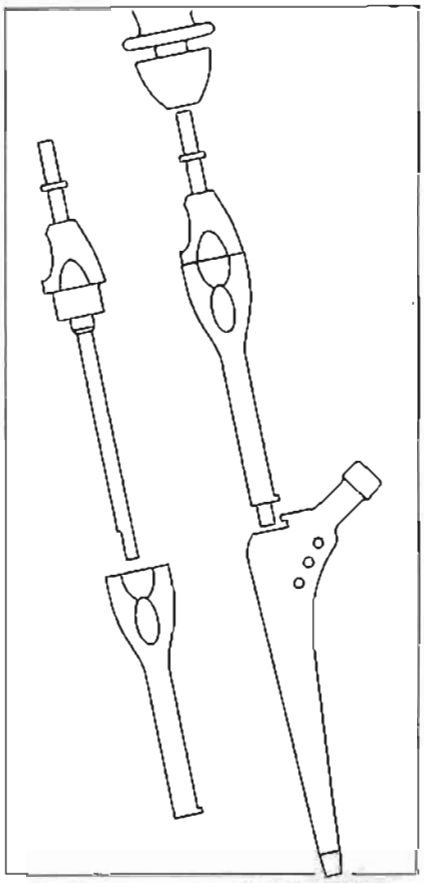

Fig. 10 – Commencing proximal impaction

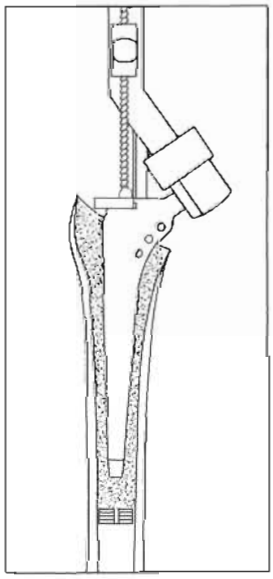

Fig. 19 – Leg length assessment

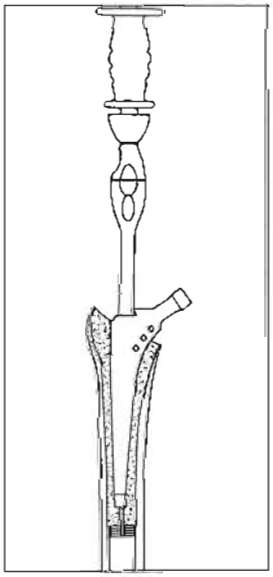

Fig. 20 – Re-connection of sliding hammer

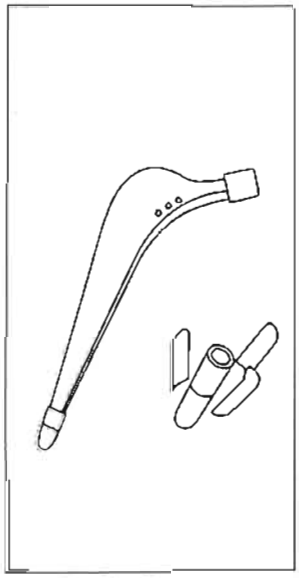

Fig. 21 – Removal of centraliser wings

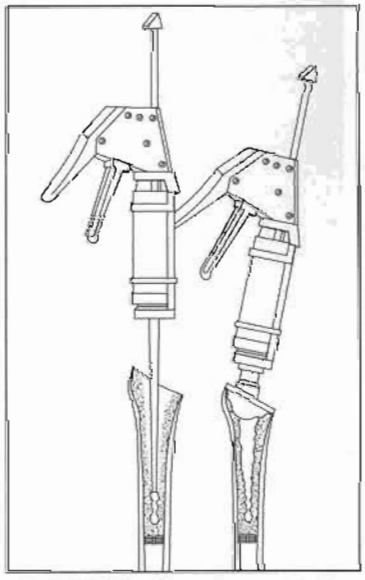

Fig. 22 & 23 – Cement pressurisation

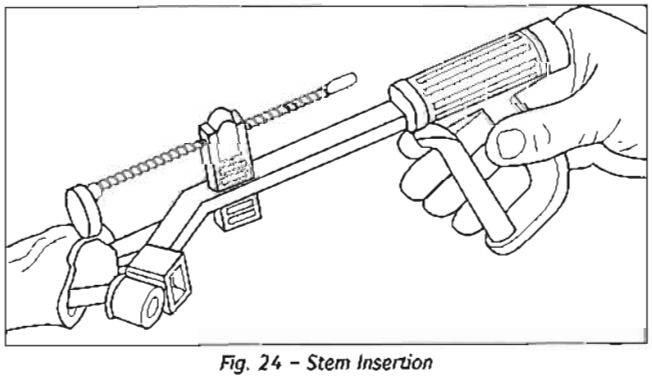

Fig. 24 – Stem Insertion

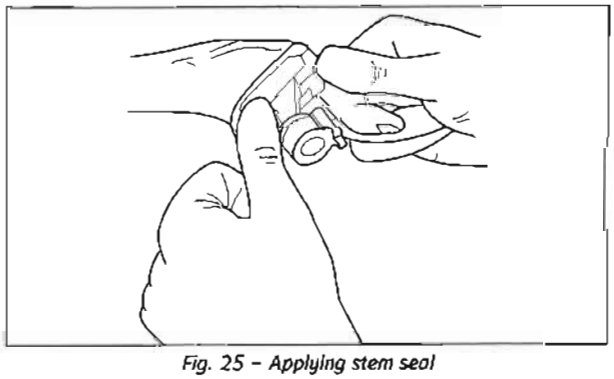

Fig. 25 – Applying stem seal

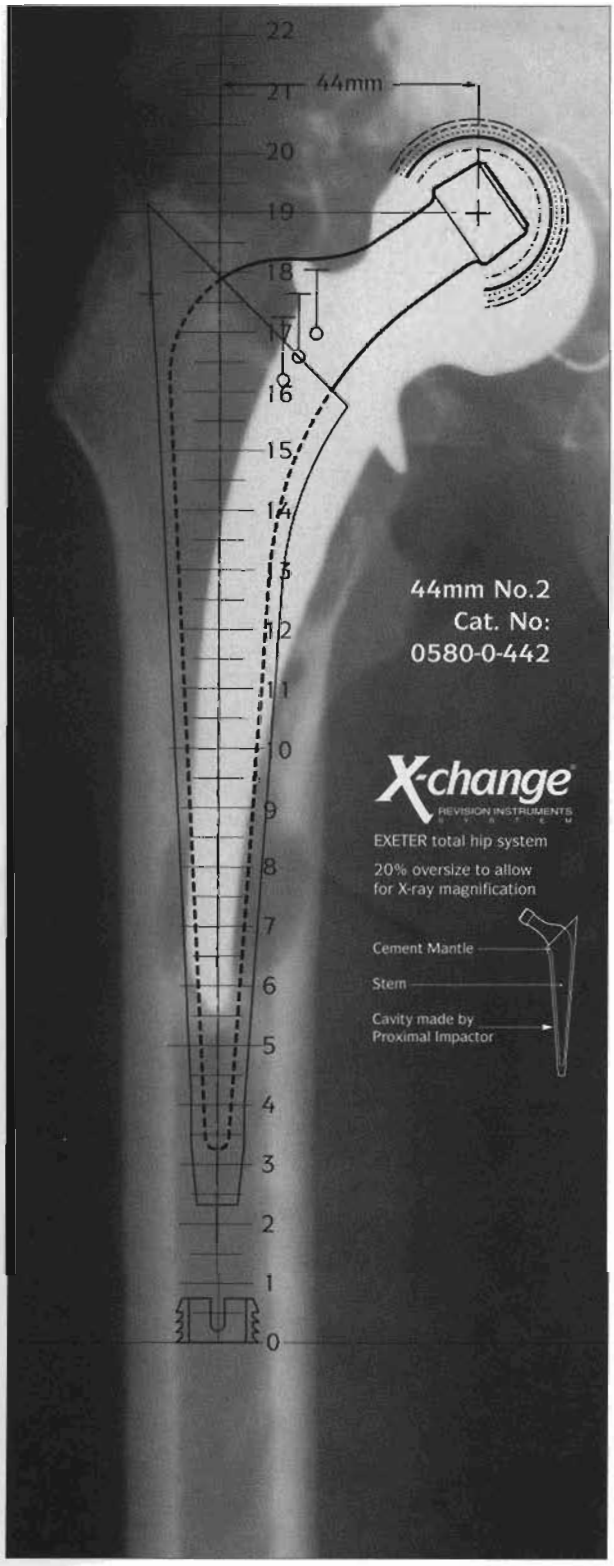

Figure 1

OPERATIVE TECHNIQUE FOR REVISION OF LOOSE COMPONENTS OF TOTAL HIP ARTHROPLASTIES UTILISING IMPACTION CANCELLOUS GRAFTING AND CEMENT

By Mr. Graham A. Gie,
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1. *Indication:*

Healthy patients with loose prostheses resulting in loss of bone stock, pain and functional disability.

2. *Pre-operative planning:*

a. *Exclusion of infection.*
This should be carried out along conventional lines. It is often not possible to exclude infection pre-operatively, though every effort should be made to do so.

b. *Analysis of bone deficiencies*
The site(s) of major bone stock loss in the femur should be clarified from X-rays, as far as possible, before surgery starts. For example, anterior femoral deficiencies are difficult to deal with unless the anterior aspect of the femur can be fully exposed.

c. *Templating:*
A.P. and Lateral films should include the whole of the femoral component and should extend distally down to the normal diaphysis beyond the femoral component.

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S Y S T E M

From these films are determined: (Fig. 1)

i. The position and size of the distal plug. The plug should be placed at least 2 cm beyond the most distal lytic area in the femur.

ii. The distance of the plug down the femoral canal against an appropriate anatomical landmark, e.g. the tip of the greater trochanter. The distance can be measured using the plug templates, and is used with the plug introducer and guide wire to position the plug at the appropriate depth.
The plug will need to be inserted at least 19cm from the proposed centre of the femoral head which is normally at the level of the tip of the greater trochanter.

iii. An estimate of the size of the Exeter stem to be used. Superimpose the appropriate X-change template on the plug template with the Exeter stem at the appropriate position. Final stem sizing is best delayed until the situation is clarified intra-operatively.

3. *Positioning the patient:*

The technique of impaction cancellous grafting is generally more effective if the greater trochanter can be retained. Retention of the trochanter improves proximal stability of the graft and femoral component.

Generally, therefore, positioning the patient on his/her side is appropriate. (Fig. 2) This will allow exposure of the posterior, lateral, and anterior aspects of the hip by suitable modifications and extensions to the usual posterior or direct lateral approaches.

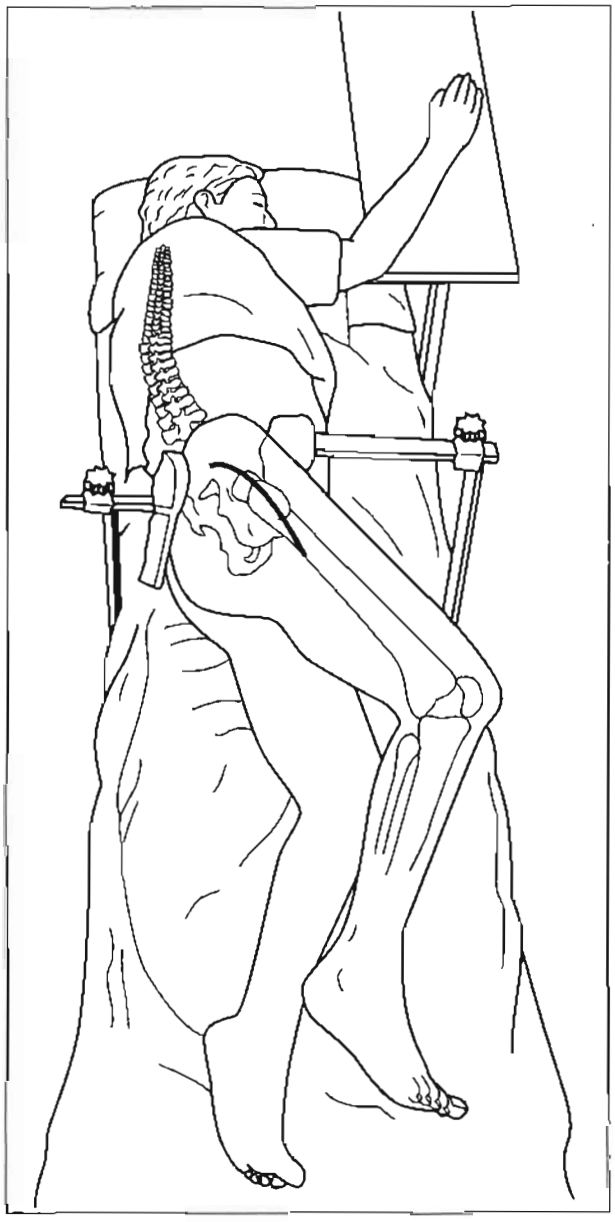

Figure 2

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4. *Surgical exposure via the posterior approach:*

a. *Incision:*
The incision should be made through a pre-existing scar wherever possible. A long incision extending up the lateral aspect of the femur and extending posteriorly from the tip of the greater trochanter is favoured.

b. *Fascial incision:*
Initially this should be through an area of fascia lata that has not been involved in previous exposures of the hip. This may be very distal, but allows the development of the subfascial plane that is later important in repairing the fascia. The tendinous part of the gluteus maximus at its insertion into the femur always requires division in this approach.

c. *Identification, exposure and protection of the sciatic nerve:*
This is a wise step at this stage. Identification should start relatively distal, where the nerve is usually free of scar tissue, and proceed proximally. Where distal exposure is not feasible, the sciatic notch may be identified proximally, and the nerve found where it enters the notch, and then traced distally. The nerve may run a very tortuous course, and can be drawn up very close to the trochanteric ridge at times.

d. *Aspiration of the hip:*
This should be repeated at this stage to obtain fluid for gram stain. Excessive neutrophils or organisms are an indication to abandon the revision and await the results of cultures.

e. *Capsular exposure and incision:*
Generally, the capsule and remnants of the external rotators are incised with cutting bovie close to their attachments to the posterior aspect of the trochanter and trochanteric ridge. They are reflected as a flap backwards from the femur, the proximal margin of the flap running along the lower border of gluteus minimus to the posterior margin of the socket,and the distal margin being the postero-inferior aspect of the capsule.
Traction sutures can then be used to hold the flap back to the posterior margin of the fascia lata. Where the capsule is very thick and scarred, the deeper portions are excised, leaving a thinner flap that is very useful for reattachment to the femur during closure. The Psoas tendon should be released from the lesser trochanter.

f. *Dislocation:*
After the mobilisation of the posterior capsular flap, the head of the prosthesis is visible. Further superior, inferior and anterior resection continues with gradual and gentle mobilisation of the femur. A large blunt hook or long gauze swab can be passed around the neck of the prosthesis, and dislocation achieved by lifting the head and neck posteriorly using the hook or the swab, rather than by rotating the femur through the lower leg. With serious bone stock deficiencies, this phase of the operation carries a risk of fracture of the femur and great care is needed in achieving dislocation with generous soft tissue release as necessary, especially from the anterior aspect of the femoral neck.

5. *Removal of the femoral component:*

Considerable soft-tissue release may be needed to achieve this in safety. Any cement or bone lying over the shoulder of the femoral component is removed before attempts are made to extract the latter. Vigorous attempts to extract the component in the presence of obstructing proximal cement or bone may lead to a fracture of the proximal femur.

In some cases it may be necessary to perform an extended trochanteric osteotomy to allow safe removal of an implant. If this type of osteotomy is performed the femoral canal should be reconstructed using cerclage wires or cables before commencing impaction grafting.

6. *Further mobilisation of the femur:*

a. *Circumferential capsulotomy:*
Always essential to achieve adequate mobilisation and delivery of the proximal femur, with subsequent restoration of leg length. Superiorly and inferiorly this is usually straightforward. Often, with gross capsular thickening, much of the capsule requires excision rather than incision. Anteriorly, there may be more difficulty, especially where scarring has been marked. It is then wise to expose the anterior aspect of the femur, and excise the anterior capsule under direct vision.

b. *Anterior exposure:*
   i. Externally rotate the leg.
   ii. A direct lateral approach is carried out in the conventional manner, taking care to protect the neurovascular bundle at the proximal end.
   iii. Anterior femoral deficiencies can be exposed by reflecting the proximal part of quadriceps by taking it off the anterior aspect of the femur below the trochanteric level.

c. *Proximal exposure of the femur:*
The proximal part of the greater trochanter must be exposed sufficiently to allow the insertion of the guide wire down the medullary canal in the midline axis of the canal, and the subsequent insertion of the proximal impactor. This means the 'neomedullary canal' that is formed by the graft is in neutral alignment within the femur, and not in varus or valgus. The width of these instruments is such as to require opening of the proximal aspect of the trochanter to approximately 1cm lateral to the midline axis of the canal, when this is projected proximally through the trochanteric region.

7. *Preparation of the graft:*

a. Fresh frozen cancellous allograft is recommended. A,B,O compatibility between graft donor and recipient is not necessary. Rhesus compatibility is important when the patient is a Rhesus negative woman of child bearing age. Autogenous cancellous chips may be mixed with the allograft if the surgeon so wishes.

b. Allograft chips are prepared by passing the bone through a mill. The size of the chips that are needed is such as to give the compressed chips some 'body' (eg 2 – 4mm). Bone slurry is not satisfactory because its consistency is too low. Larger chips up to 10mm in size can be mixed with the smaller chips for packing of the proximal femoral canal around the phantom.

c. At least two femoral heads should be available, and more if femoral bone stock loss is severe and/or the acetabulum requires grafting.

8. *Preparation of the femoral canal:*

a. *Removal of cement:*
Cement removal must be total with one exception: If the existing distal cement plug is greater than 2cm beyond the most distal lytic area in the femur and is solidly fixed, and there is definitely no infection, it may be left in position.

b. *Removal of all granulomata and fibrous membrane:*
This must be complete and thorough, and followed by copious irrigation of the canal. Membrane remnants should be used for frozen section and microbiological examination.

c. *Repair of defects in the femur: (see section 9 and appendix)*
The success of this revision technique depends on adequate physical constraint for the graft. Structural defects in the femoral diaphysis must therefore be made good before impacting the graft. For technical details of the methods of repair, see appendix (page 18).

It is essential that the proximal femur is reconstructed up to a level that corresponds to the level of neck section preferred at a primary hip replacement. As a guide, the femoral component should never be positioned so that the lowest of the marks on the anterior and posterior aspects at the base of the neck lie above the level of the graft. (see section 9)

d. *Prophylactic cerclage wiring of the femur:*
This is recommended where the femoral cortex is especially flimsy. Under such circumstances, vigorous packing of the canal can produce a split in the diaphysis. This is more easily managed if cerclage wires have been applied before the split occurs. Overtightening of the wire may crush the femur when its structure is seriously compromised.

9. *The repair of femoral cortical defects:*

a. *Diaphyseal defects:*

If these are small and completely sealed at their margins by soft tissues, they can be ignored and simply packed with chips from within.

Larger defects should be exposed surgically, their margins clearly defined, and all associated granulomatous material and fibrous tissue removed. These defects are repaired by using a combination of stainless steel mesh (see appendix) and cerclage wires. Once the defect has been closed in this way, the operation proceeds as though no defect were present. Cortical healing can be anticipated.

Large defects particularly near the tip of the prosthesis, should be bridged either by a long stem implant, a femoral plate or strut grafts.

b. *Metaphyseal defects:*

These are best repaired following trial reduction, performing the reconstruction with the proximal impactor in position, ensuring an adequate gap between mesh and prosthesis.

The defect must be repaired in such a way that the proximal allograft chips can be fully constrained, and thus made capable of taking some load. This is achieved by applying the X-change® mesh, held in position with a suitable cerclage technique. (see appendix)

10. *Distal occlusion of the femur:*

There are three possibilities:

a. **Where a new (threaded) Intramedullary plug is to be used:** (Fig. 3)

The threaded I.M. plug is screwed onto the guide wire.

The plug introducer sleeve is passed over the guide wire. The guide wire introducer is then assembled onto the handle assembly and the plug is impacted to the appropriate level.

Typically, this should be to a depth of at least 19cm from the proposed centre of the femoral head and 2cm distal to the most distal lytic area, whichever is the greater. The minimum plug depth is marked on the guide wire.

The plug must be a tight fit.

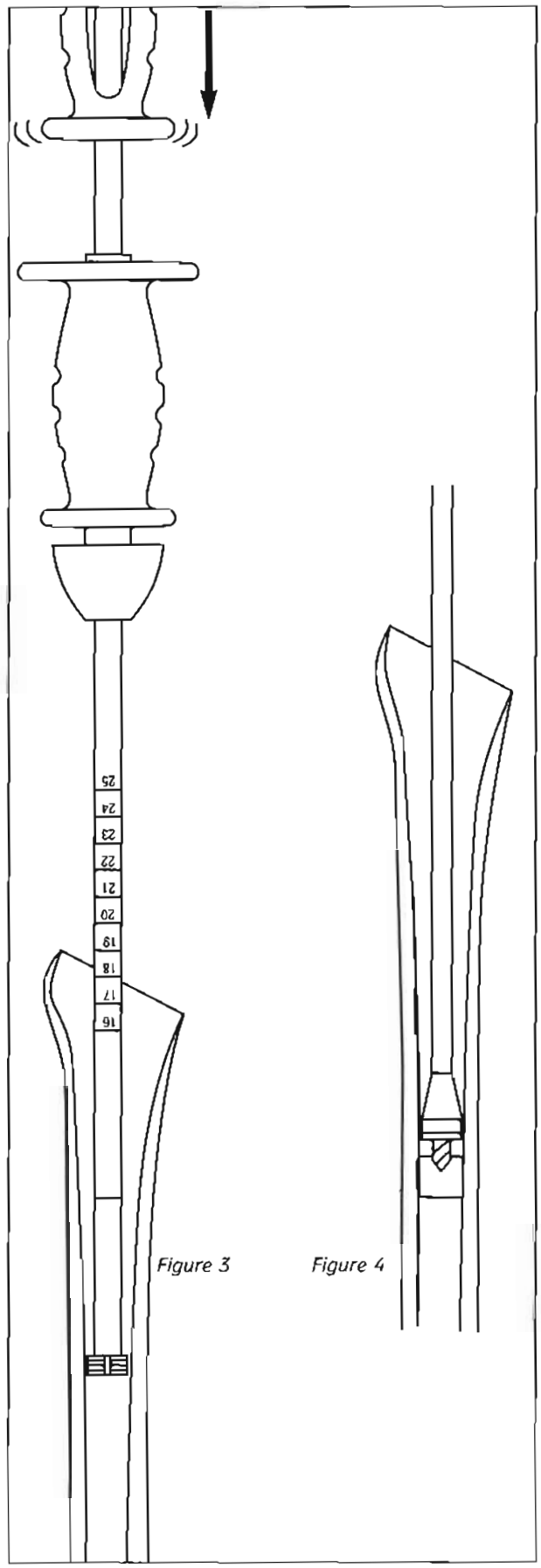

Figure 3

Figure 4

b. **Where there is a suitable cement plug which is to be left in situ:** (ref: 8a) (Fig. 4)

The largest impactor that will fit is placed down to the level of the plug, to act as a drill centraliser.

The I.M. drill is passed through the impactor and the cement drilled. (The I.M. drill will require replacing after repeated use).

The guide wire is then passed through the impactor and screwed into the pre-drilled hole using the T-handle. The impactor is then removed.

c. **Where a new (threaded) intramedullary plug is required beyond the isthmus:**

A 2mm K-Wire is drilled through both cortices at the desired level. The pointed end of the plug is cut off to make a flat end. It is then inserted into the canal and placed on top of the K-Wire.

11. Sizing the proximal impactors:

The plug introducer sleeve is removed and the canal then sized for proximal impaction.

Starting with the largest proximal impactor and then inserting progressively smaller proximal impactors, the first one which falls easily into the canal is the correct size for use.

Care should be taken that the guide wire is not driven into varus as the proximal impactor is inserted. If it is, further development of the slot into the trochanter is necessary until neutral alignment of the proximal impactor can be achieved.

Neutral alignment is best checked by reference to the middle of the popliteal space (when the posterior approach is being used) or to the patella (when the direct lateral approach is used).

12. Impaction of the graft:

a. Wash and suck out the distal canal to remove any debris.

b. *Sizing the distal impactors:* (Fig. 5)
Before using the impactors to impact the bone chips, it is important to establish the distance that each size of impactor can be passed into the femoral canal without jamming against the walls of the canal. Driving the impactors beyond this point runs the risk of splitting the femur. Take each impactor in turn, pass it over the guide wire, noting the depth of insertion, by clipping a marker onto the groove opposite the tip of the greater trochanter, or equivalent mark. (Fig. 5a)

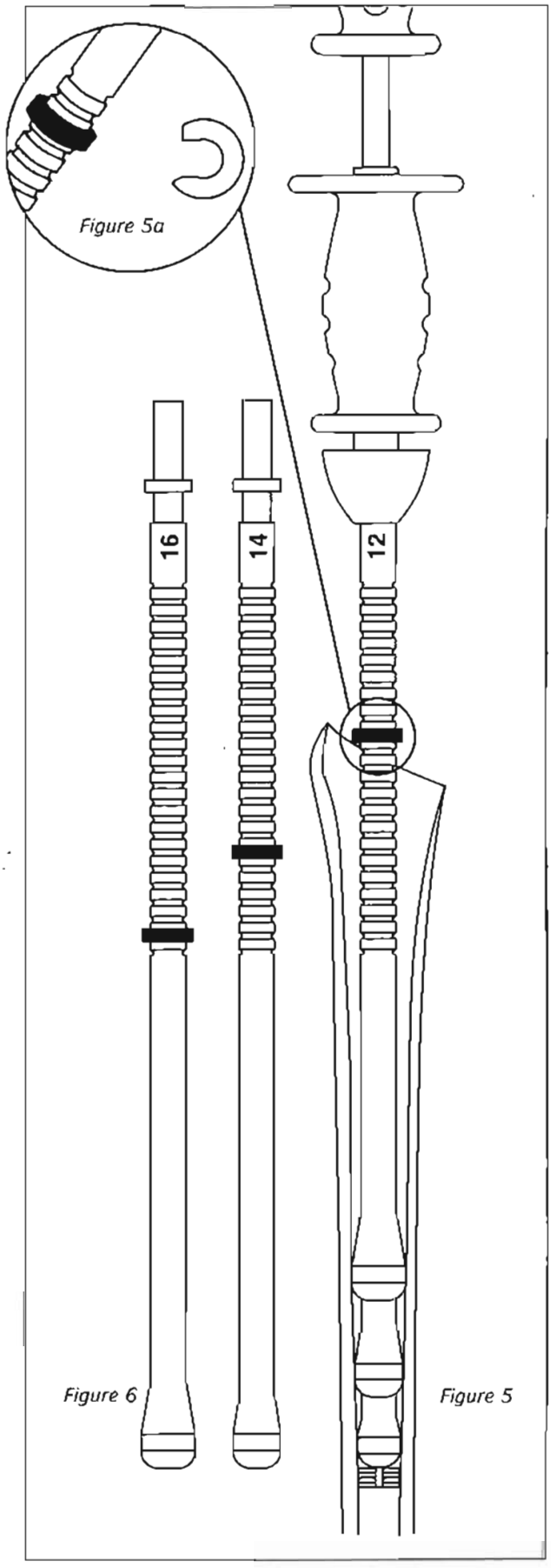

Figure 5a

Figure 6

Figure 5

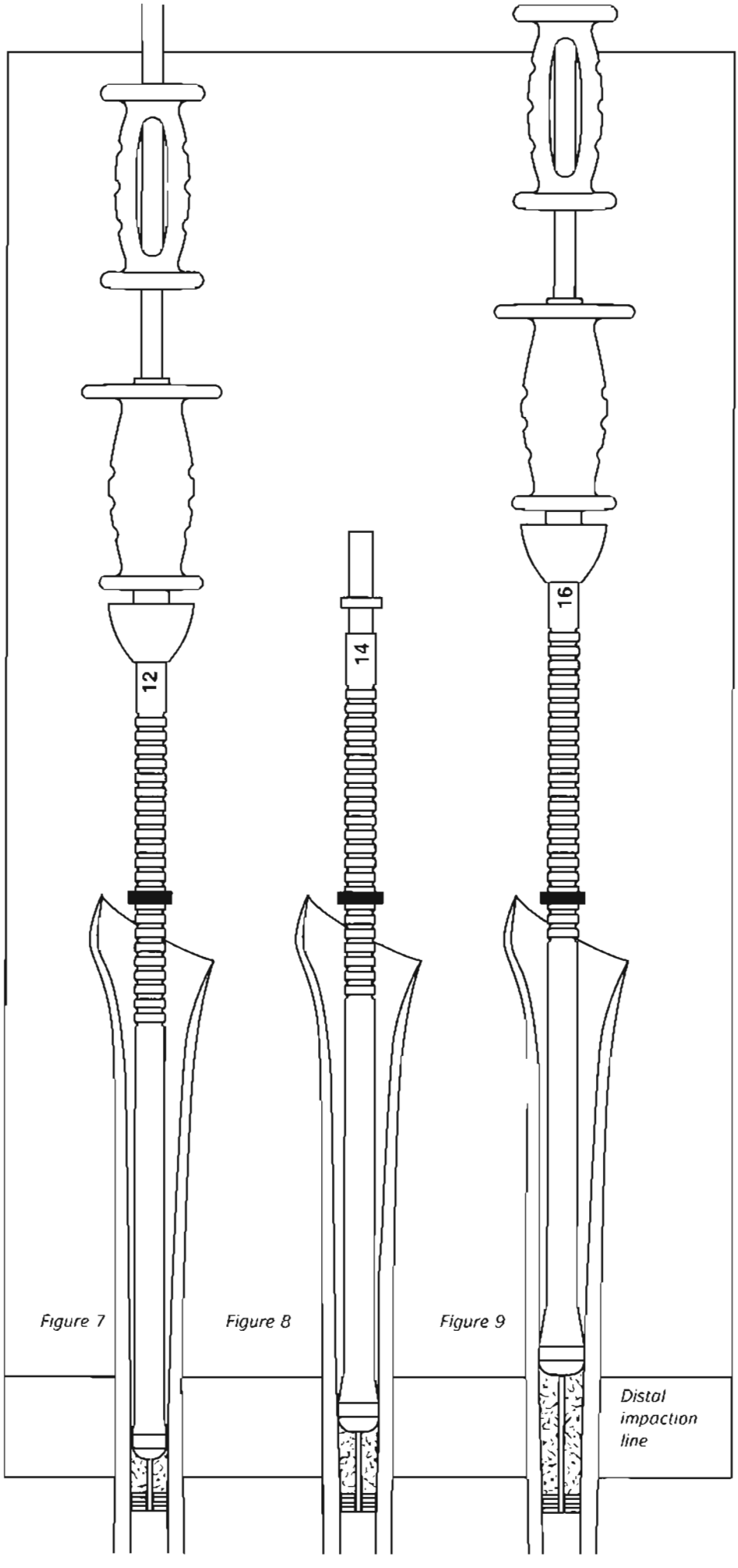

Figure 7

Figure 8

Figure 9

Subsequently, when impacting the bone chips, do not drive each impactor beyond its marker clip (Fig. 6). (It will be necessary to replace the marker clips after repeated use).

If the plug is noticed to be migrating during impaction,as indicated by the depth markings on the guide wire, skewer it with a percutaneous K-wire.

c. Introduce allograft chips proximally around the guide wire. Push as far distally as possible using your fingers then use the large impactors hand-held to push the bone chips further down the canal. 1cm of graft should be packed on top of the plug by using the distal impactors **by hand**, before starting to use the sliding hammer. This prevents distal migration of the plug. At this stage, the impactor should be carried on the handle assembly and the sliding hammer should be used. (Fig. 7) Continue this process by introducing and impacting more chips, using progressively larger impactors in relation to canal diameter. Check the depth of the guide wire after each instrument has been used to make sure the plug is not migrating. Continue this process of packing until the distal impactor cannot be introduced beyond the 'distal impaction' line. *
(Fig. 7-9)

* *Note Distal Impaction Line*

The surgeon should start using the proximal impactors when the distal impaction line is reached. This point is marked by the end of the polished area on the distal impactors (for standard length stems).
The distal impaction line is the depth that the tip of the stem will reach on implantation. For the core range of stems (with offsets of 37.5mm, 44mm and 50mm), the distal impaction line is 155mm from the eventual centre of the femoral head.
For the 205mm Long Tapered Stem, the distal impaction line is at 205mm and this should be indicated by clipping a marker on the distal impactor in the groove immediately above the '20' mark.

For the smaller stems of offsets 30mm, 33mm and 35.5mm, three rings marked within the polished region indicate the respective lengths of these stems.
It is important not to continue with distal impaction other than by hand beyond the distal impaction line as this might make it impossible to insert the proximal impactor to the correct depth.

d. Mount the appropriate proximal impactor on the handle assembly and pass it over the guide wire. (Fig. 10)

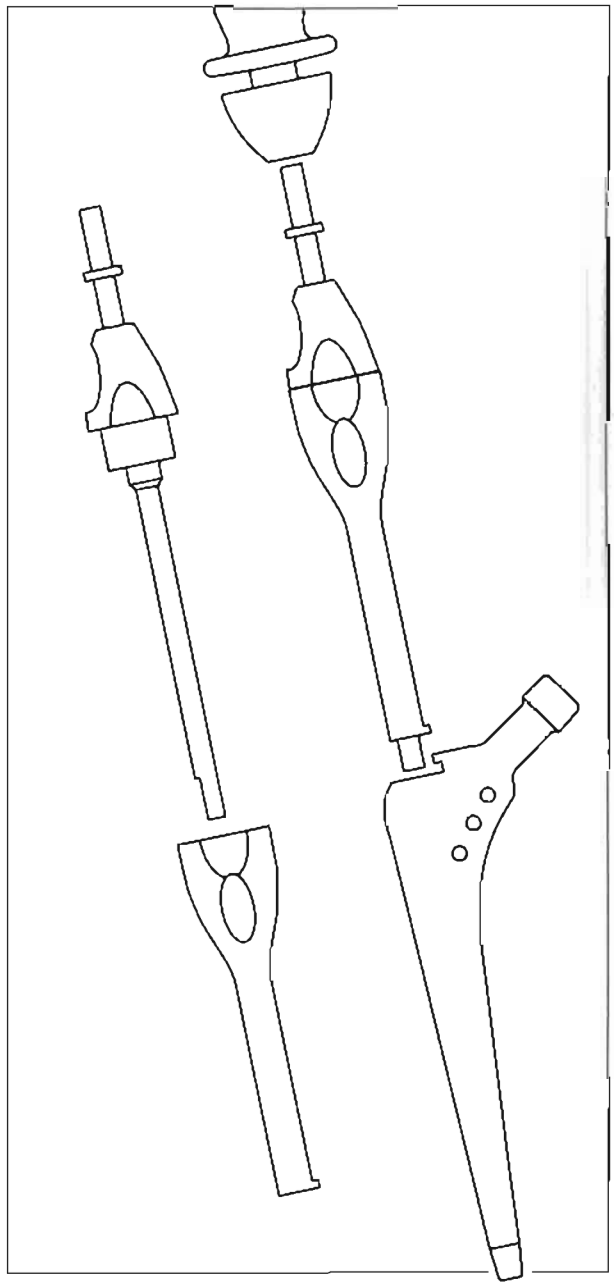

Figure 10

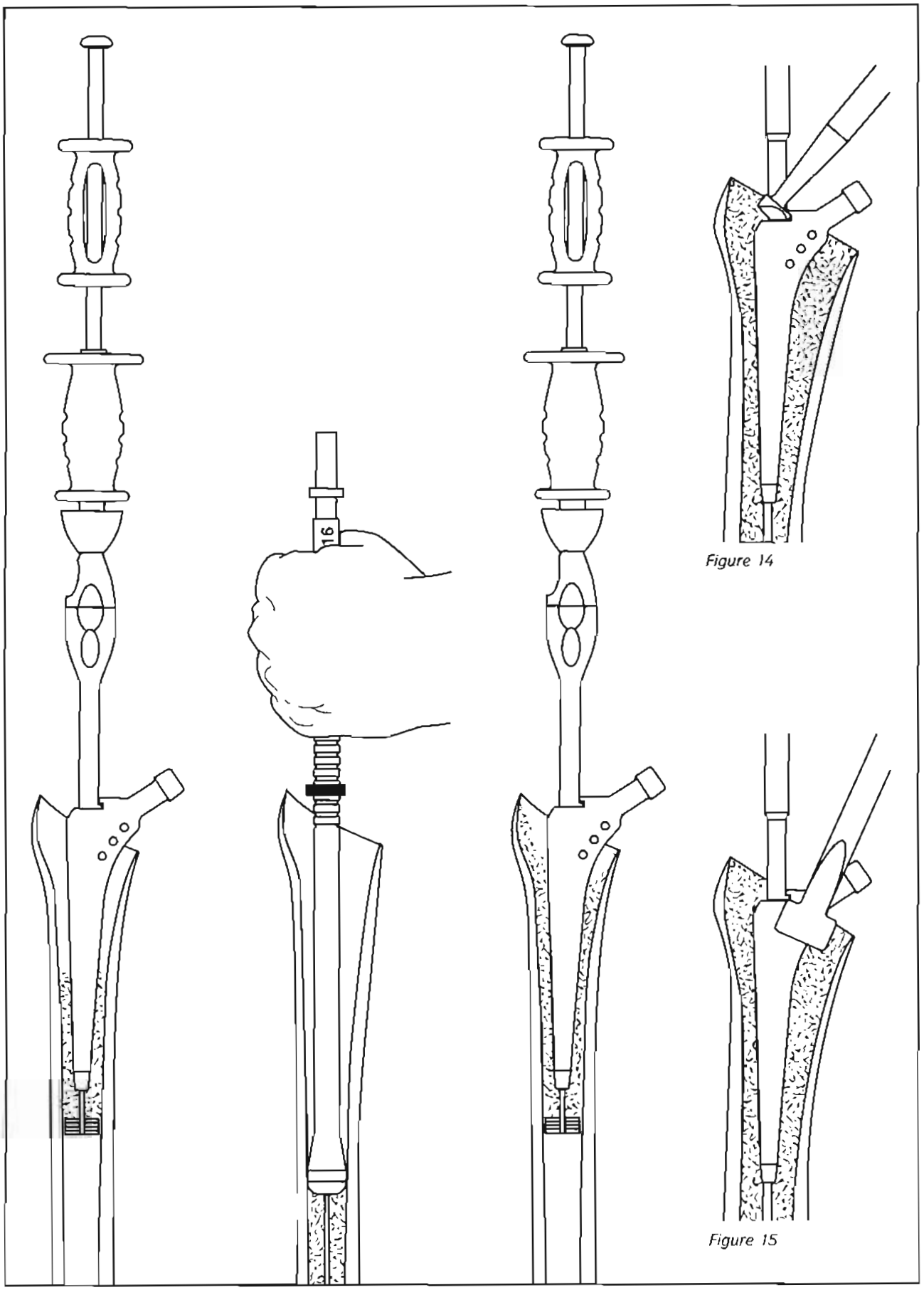

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

Load graft into the proximal femur. Using the sliding hammer, drive the proximal impactor distally into the chips to force them up against the walls of the canal. Use the handle assembly to control the rotational position of the proximal impactor, and ensure that the 'neo-medullary canal' so formed is in the correct anteversion*. The proximal impactor should be driven vigorously into the chips. (Fig. 11)

e. Withdraw the proximal impactor from over the guide wire, insert more chips and then impact them, using the distal impactors by hand. (Fig. 12)

Continue to use the distal impactors by hand, alternating them with the proximal impactor, until you are happy that the graft in the mid-stem region is adequately packed.

f. As the canal is filled from below upwards, continue to insert the proximal impactor over the guide wire, and again drive the proximal impactor into the chips, using the sliding hammer. (Fig. 13)

The proximal impactor should now be getting tighter. If it is not then look for fractures.

g. The proximal impactor should be driven into the desired depth as indicated by templating. Final proximal packing is achieved using the block and 'half moon' impactors. Larger chips should be mixed with the smaller chips. (Figs. 14 & 15)

If the graft is so tight that the proximal impactor cannot be introduced fully, use one size smaller for final impaction. Select the stem size on the basis of the size of the proximal impactor that is used for the final packing.

h. **The surgeon must ensure absolute axial and torsional stability of the proximal impactor at the conclusion of packing. It is emphasised that it should be impossible to withdraw the proximal impactor without using the sliding hammer.** (Fig. 16)

i. It is normally possible to do a trial reduction with the guide wire in place. If not possible then the guide wire is unscrewed from the plug and withdrawn from the femur. (Fig. 17)

* Note that a small guide rod may be inserted into the threaded hole in the upper flange of the handle to improve assessment of anteversion.

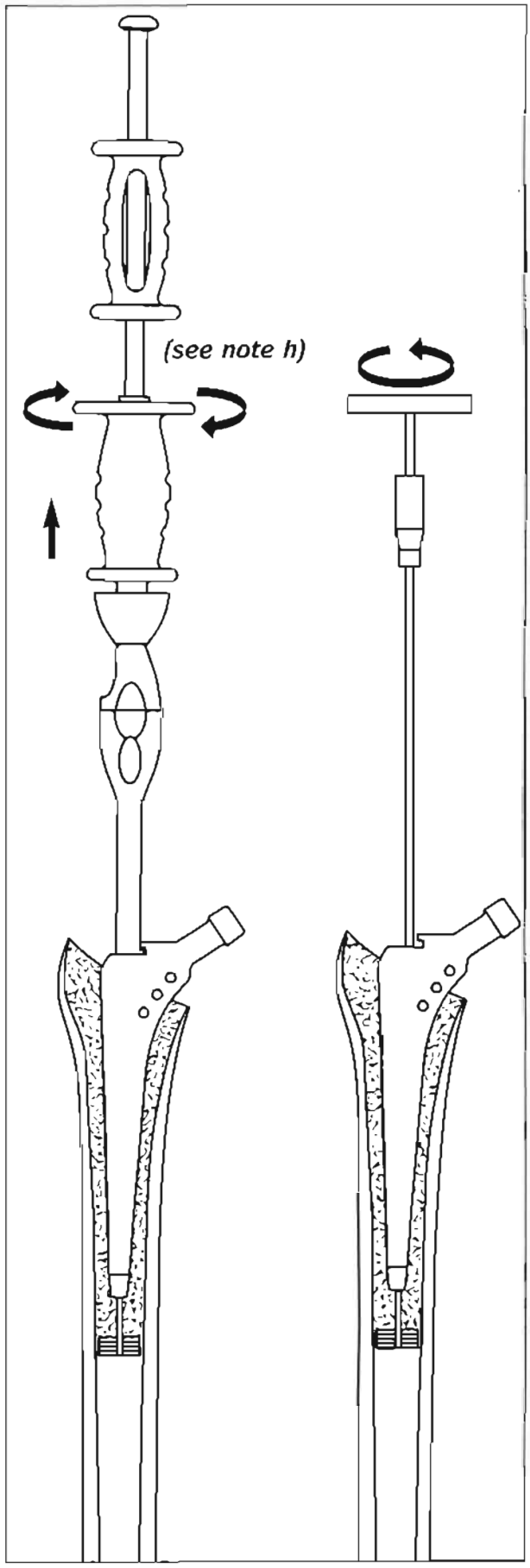

Figure 16

Figure 17

13. Trial reduction:

This allows assessment of stability and leg length, and acts as a further guide for the depth of stem insertion.

a. The hip is reduced with the appropriate trial head in place. (Fig. 18)

b. Any changes to the depth of insertion of the stem can now be estimated by the relative leg lengths of the patient. If the leg is short, impaction is continued to further build up the femur.

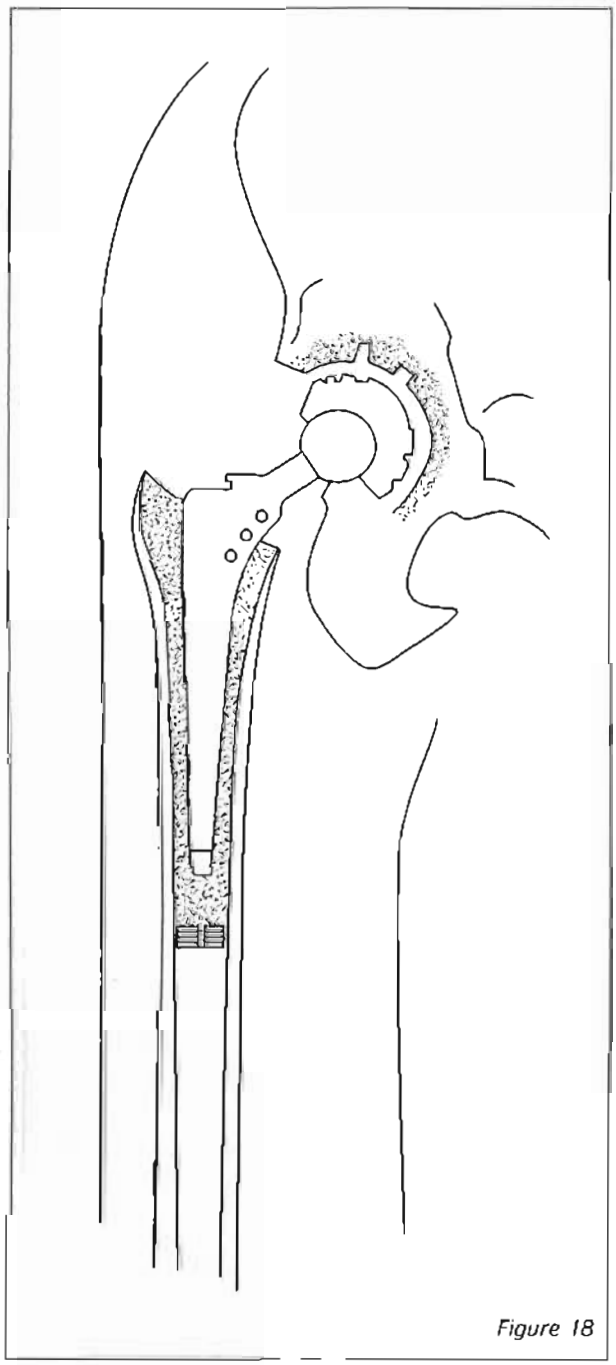

Figure 18

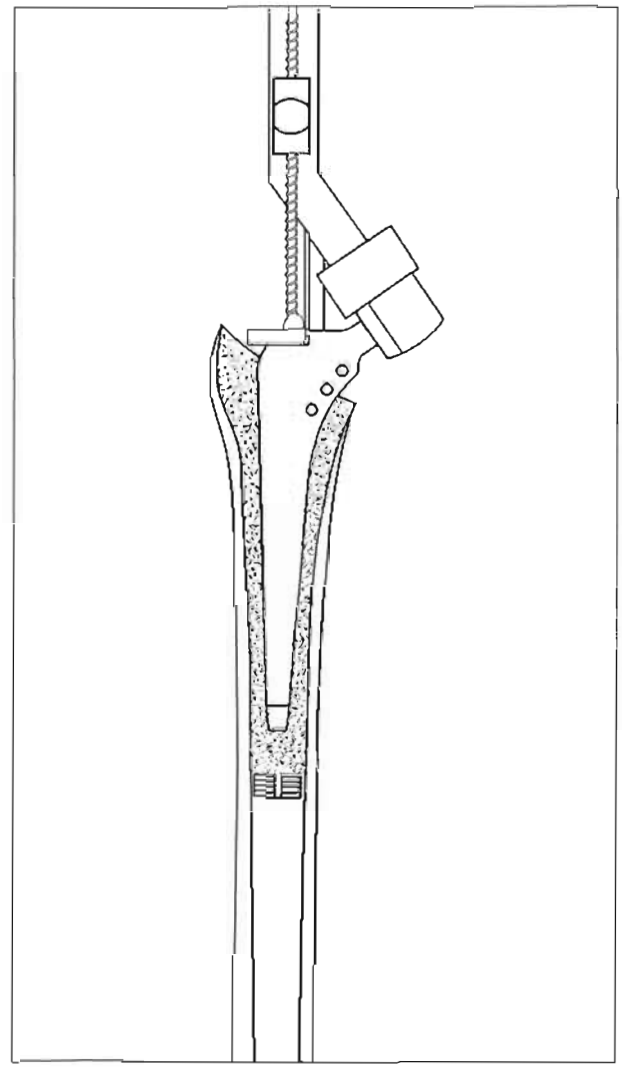

Figure 19

c. Carefully redislocate the hip. Remove the trial head.

d. Once you are happy with your stem position and trial reduction, remove the guide wire using the 'T' handle.

e. If a metaphyseal defect is present, this is the appropriate time to apply X-change® mesh. (see section 9b and appendix)

f. Attach a spigot protector accurately over the trial stem spigot, and assemble the stem introducer (with leg-length gauge) onto it. (Fig. 19)

g. Adjust the "traveller" on the leg-length gauge to a convenient position in relation to the upper end of the femur.

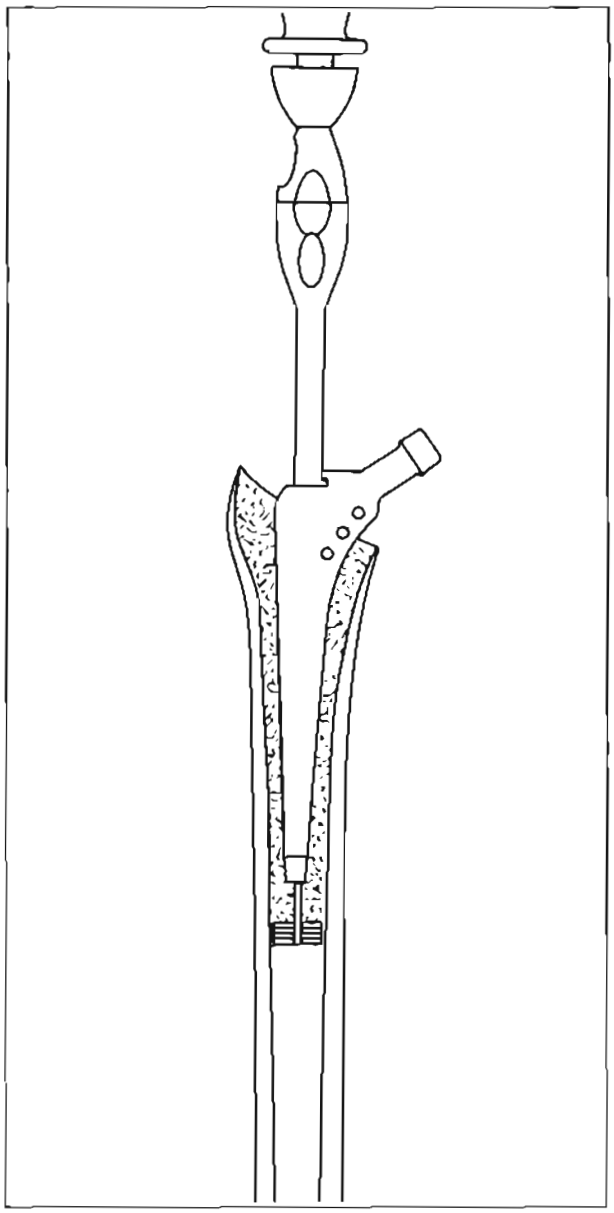

Figure 20

h. Mark the position of the distal end of the "traveller" on the femur by marking with bovie and methylene blue dye. The mark on the femur not only helps achieve the desired leg length but is a useful guide to indicating correct alignment. The "traveller" will not be parallel to the mark if the stem is in varus or valgus.

i. In addition, the marks on the stem can also be used to gauge and check stem insertion depth.

j. Carefully remove the stem introducer, and avoid disturbing the position of the leg-length gauge.

k. Ensure that the connection on the shoulder of the proximal impactor is clear of bone graft debris or soft tissue and replace the impactor connector in preparation for removal of the proximal impactor prior to cement insertion. (Fig. 20)

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14. Cement insertion and stem introduction:

a. Leave the impactor in position until just before cement insertion. This keeps the graft compressed and the canal can be sucked dry by a catheter placed down the trial lumen.

b. Remove the wings from the Exeter stem centraliser and hold it in position on the stem tip. (Fig. 21)

c. Insert Simplex® cement retrograde from the cement gun, using the tapered gun spout (Fig.22). The time of insertion will depend upon the type of cement being used. Relatively low viscosity cement is recommended, to ensure adequate penetration of the graft. **Two 40g mixes of Simplex are required to allow adequate cement for continuous pressurisation prior to stem insertion.**

d. Once the canal has been filled retrograde, apply the proximal femoral seal, cut off the nozzle at the level of the seal and pressurise the Simplex® cement into the graft. (Fig. 23)

e. Maintain pressurisation until the viscosity of the Simplex cement is appropriate for stem insertion.

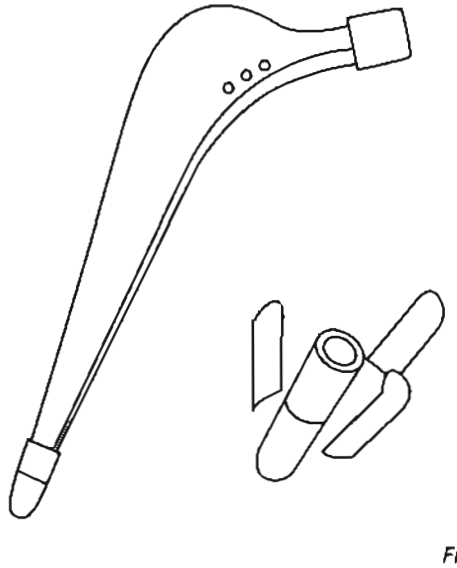

Figure 21

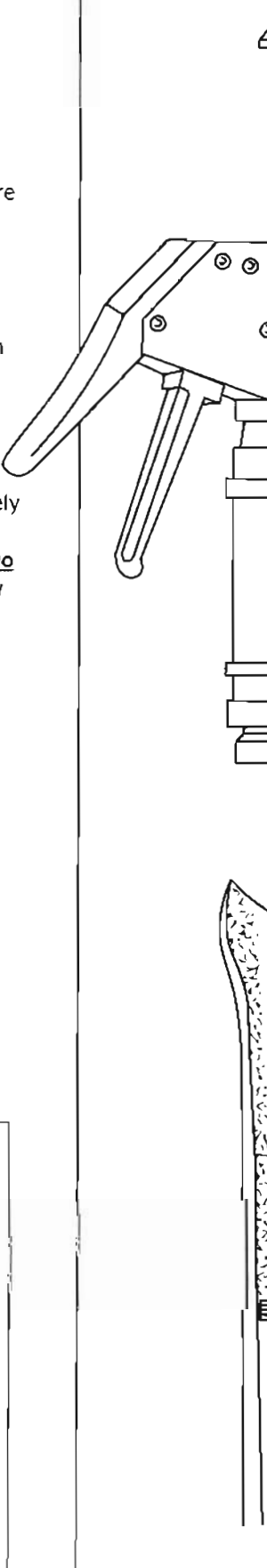

Figure 22

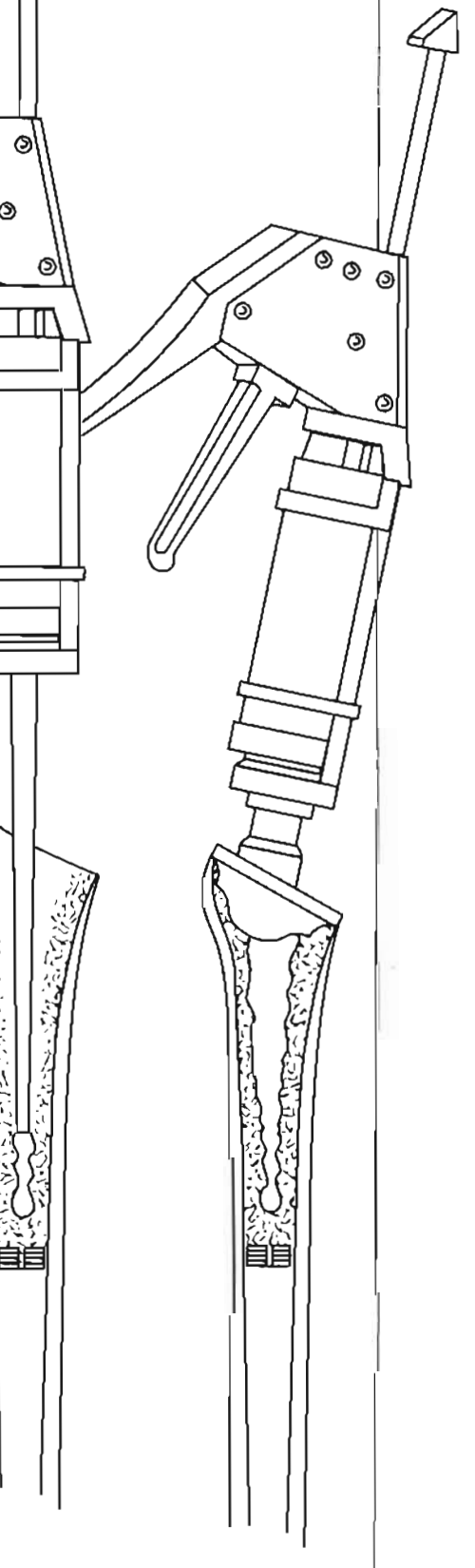

Figure 23

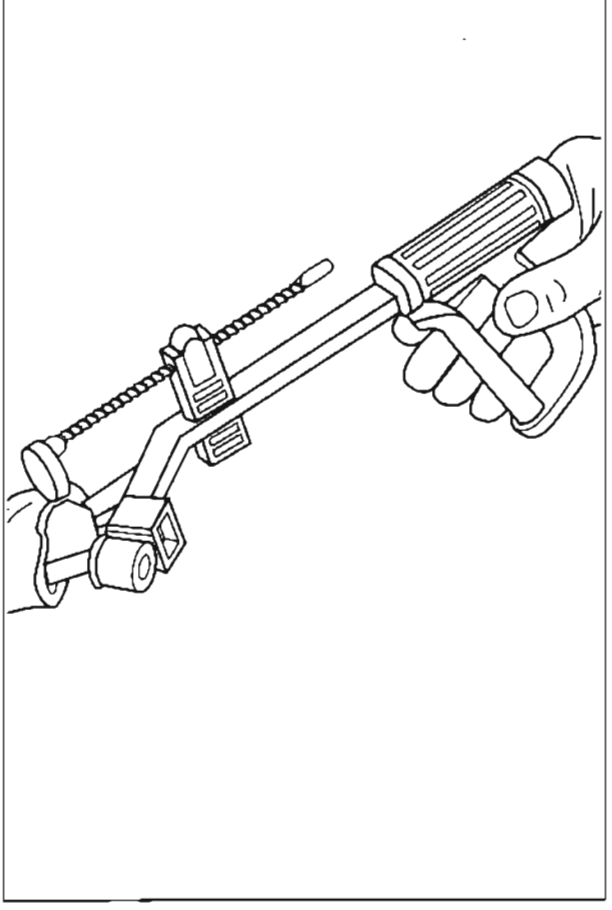

Figure 24

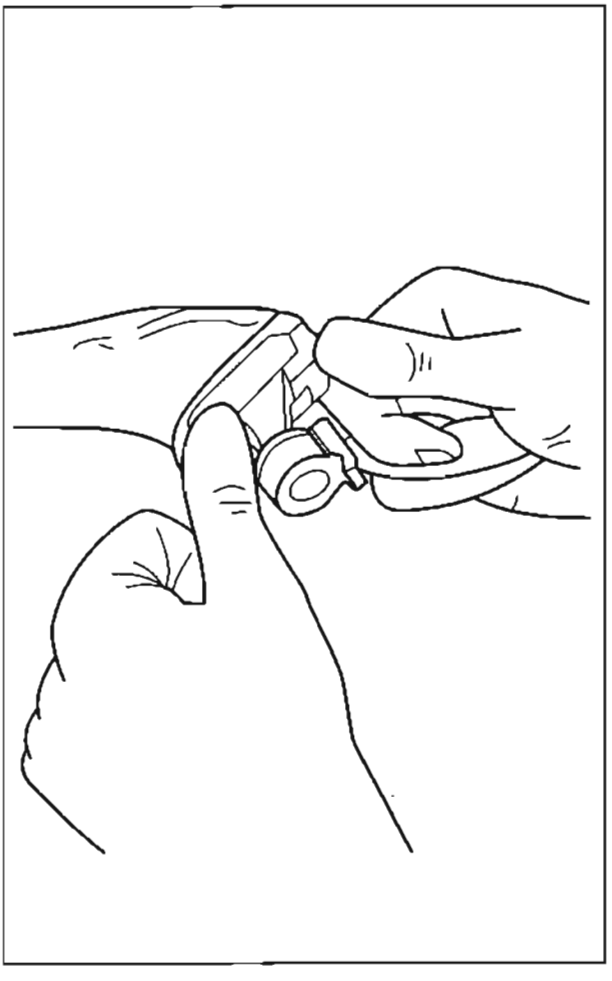

Figure 25

f. Insert the Exeter stem to its predetermined position by using the leg-length gauge. Attention must be paid to the alignment of the stem during insertion. (Fig. 24) The surgeon must use his thumb to occlude the exit from the medullary canal on the medial side of the stem, and thus maintain pressure on the cement throughout insertion.

g. **As soon as the desired insertion depth is achieved, the stem introducer is removed.** Apply the stem seal around the proximal stem, and maintain pressure on the seal until the cement has polymerised, ensuring that the stem does not back out during polymerisation. (Fig. 25)

15. Reduction and closure:

These manoeuvres are carried out according to the surgeons usual practice. A layered closure, including the fat, is regarded as important, together with adequate drainage.

16. Postoperative management:

This has to be individualised according to the differing circumstances of each revision. Femoral revisions with major socket reconstructions may require a period of bed rest before allowing the patient up to touch weight-bear with crutches. Similarly, very severe bone stock loss on the femoral side may demand a period of bed rest. More straightforward femoral reconstructions can be mobilised with crutches, touch weight bearing, within 2-4 days. Major soft tissue deficiencies sometimes need 3 weeks bed-rest.

Touch weight bearing is maintained for 3 months, and weightbearing is then gradually increased, changing to a single crutch, and then onto canes and subsequently a single cane, as circumstances allow.

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APPENDIX ONE

Use of X-change® Mesh

The primary objective for the surgeon in using impacted allografts and cement is to create implant stability. Implant stability in impaction grafting depends on constraint for the graft, impaction of the graft and the injection of cement into the graft surface. Constraint is normally provided by surrounding bone but where this is defective in either the socket or the femur, some form of artificial constraint has to be created by the surgeon before the impaction is performed. The most effective way found so far to create this constraint is by the use of the perforated mesh, fixed appropriately to the bone so as to close off the bony defect or deficiency. The main purpose of the mesh is to provide constraint for the graft and not, for example, to reinforce the structure of the femoral diaphysis. Mechanically, it is quite unable to perform the latter function on its own and if it is used in this way to make up circumferential deficits in the femoral diaphysis, failure is inevitable. In this situation where replacement or reinforcement of the femoral diaphysis is needed, the mesh must be supplemented by the use of strut grafts, a plate or a combination of the two. The struts and plate must extend a sufficient distance above and below the defect to be effective mechanically. Where femoral deficiencies are sited near the tip of a standard length stem the mesh, strut graft and/or plate may have to be reinforced by the use of a longer stem.

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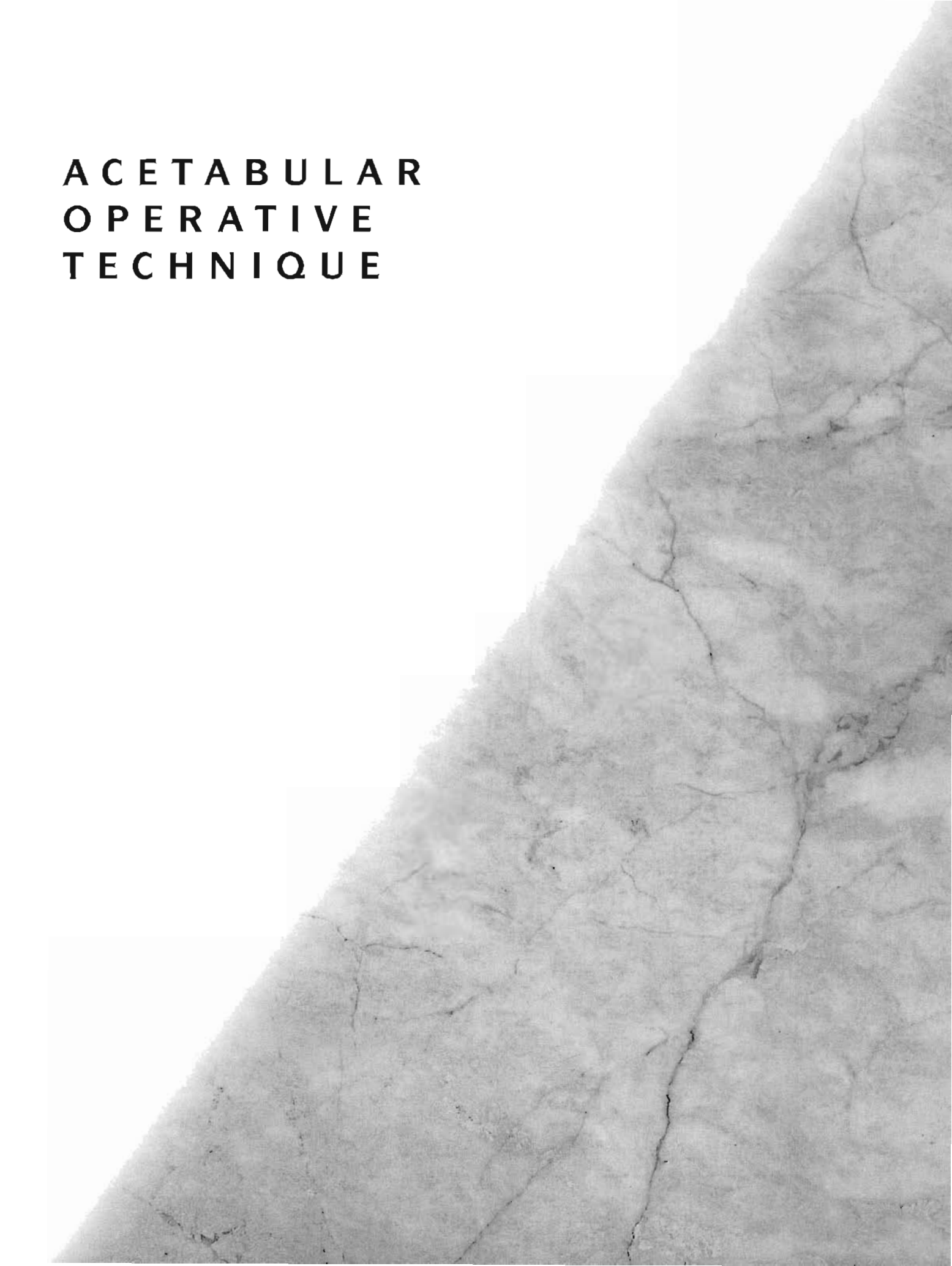
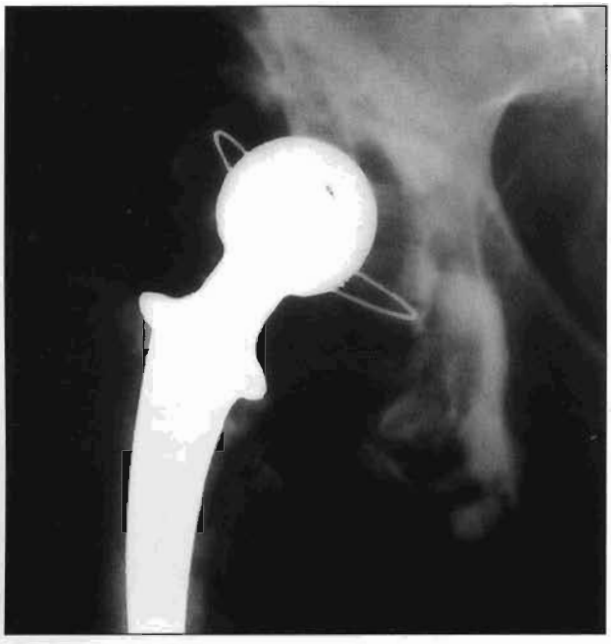
ACETABULAR OPERATIVE TECHNIQUE





ACETABULAR RECONSTRUCTION WITH IMPACTION GRAFTING AND CEMENT

Prof.T.J.J.H. Slooff,
Dr. J.W.M. Gardeniers,
Dr.B.W. Schreurs,
University of Nijmegen, The Netherlands.

Introduction:

Bone loss encountered during total hip arthroplasty may be due to pre-existing dysplasia, previous trauma, tumour conditions, infection, implant loosening and periprosthetic lysis. In all of these circumstances, the major problem is the loss of bone. This results in the loss of structural integrity and impairment of mechanical support for the implant.

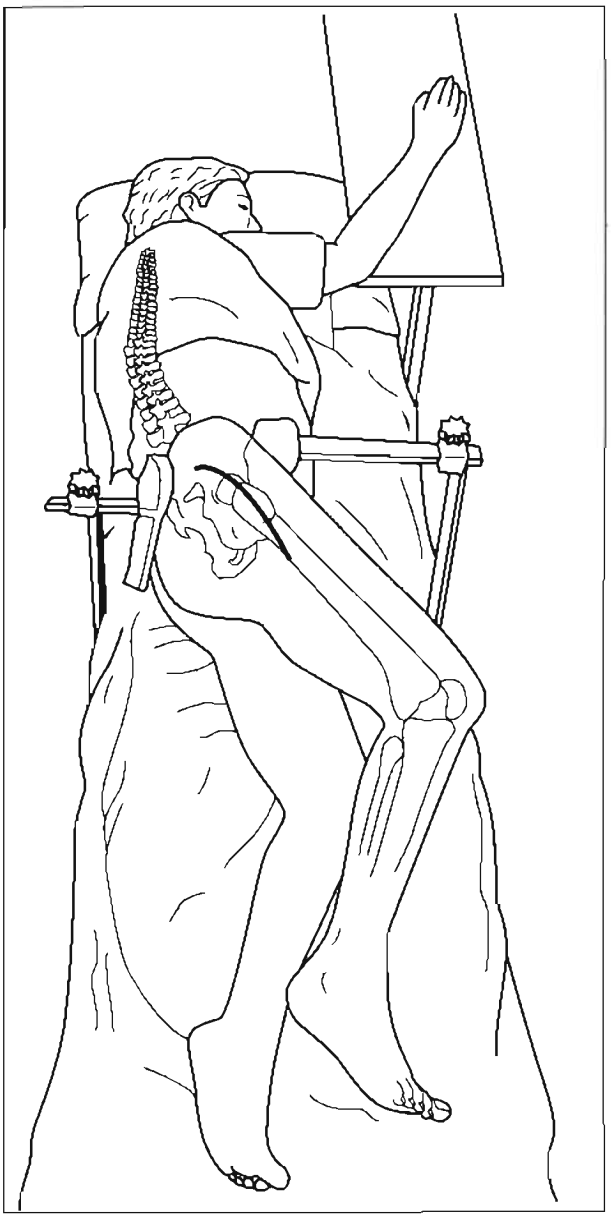
The treatment goals for bone loss are:

- the repair of hip mechanics by positioning the cup in the anatomic location.
- the repair of defects by closing the segmental defects to achieve containment.
- the replacement of bone loss by filling the cavity defects with allograft bone chips.
- the restoration of stability by impacting the chips and the use of bone cement.

These goals can be achieved by using the acetabular X-change Revision Instruments System. They help provide a stable acetabular reconstruction by packing the contained acetabulum with allograft bone chips at the correct anatomical location.

Positioning the patient:

Generally, positioning the patient on their side is appropriate. This will allow exposure of the posterior, lateral, and anterior aspects of the hip by suitable modifications and extensions to the usual posterior or direct lateral approaches.



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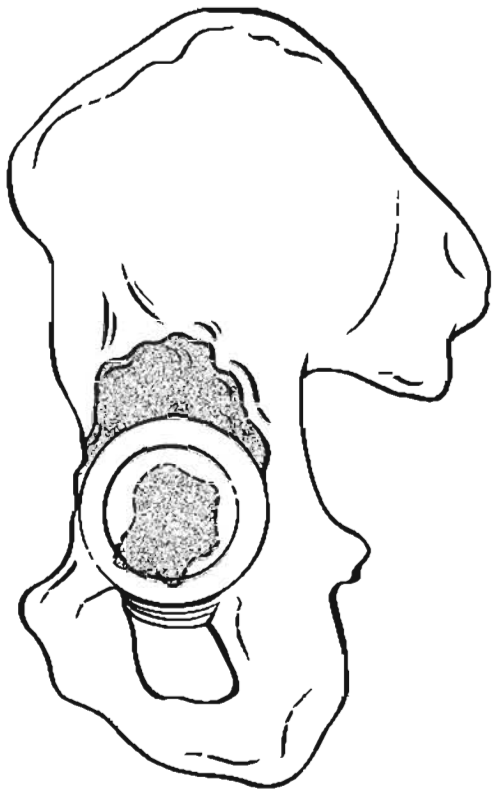
Surgical exposure:

Identification of the major landmarks and of the sciatic nerve may be helpful to reference the anatomy, as this may be disturbed by scarring and distortions. These landmarks are the tip of the greater trochanter, the lesser trochanter, the tendinous part of the gluteus maximus and the lower border of the gluteus medius and minimus. Aspiration of the hip should be undertaken at this stage to obtain fluid for gram staining.

The proximal part of the femur is extensively exposed and mobilised before the hip is dislocated. A very wide exposure of the entire socket is essential by removing all scar tissue, performing a circumferential capsulotomy, and dividing the iliopsoas tendon.

After removing the components and the cement, the fibrous interface is thoroughly freed from the irregular acetabular wall using sharp spoons and curettes.

Special care is given to locate the transverse ligament at the inferior aspect of the acetabulum. This is the best landmark for positioning the inferior edge of the socket. Beginning at this position the reconstruction can be built up in order to restore acetabular form.



Trial Cup against transverse ligament

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Preparation of the acetabulum:

It is important not to remove more bone than is absolutely necessary, as the remaining bone is the foundation for the new socket. The use of instruments and the handling of the bone is a delicate operation because of the irregular shape of the acetabulum which has usually been considerably enlarged.

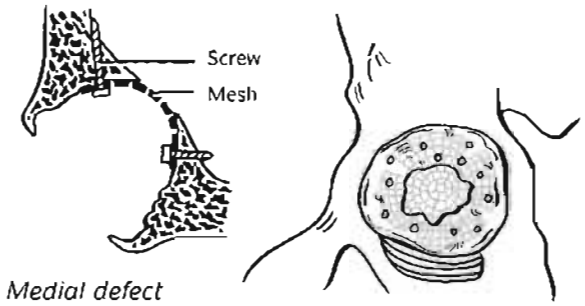
The sclerotic acetabular wall is subsequently "revitalised" with multiple small but superficial drill holes to enhance surface contact and to initiate vascular invasion into the graft. The acetabulum is then lavaged.

Reconstruction is preceded by placing the trial acetabular cup at the level of the transverse ligament visible as the tear drop on X-rays, i.e. recreating the anatomical position of the acetabulum. By doing this an estimate is gained of the amount of bone graft required.

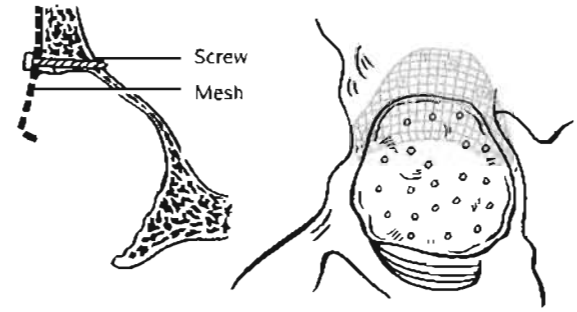
Where containment of the graft is compromised by segmental bony defects, it must be achieved by using flexible wire mesh fixed to the wall of the ilium by screws.

The medial and the peripheral segmental defects are evaluated. Flexible stainless steel meshes can be trimmed and adapted to the defects. At the periphery these are fixed with small screws at a minimum of three points, normally more, to secure rigidity (Bicortical where possible). The medial segmental defect may also be covered with the metal mesh or, in the case of a very small defect, with a structural corticocancellous bone graft. After closing these segmental defects, the acetabulum is reformed leaving only cavity defects to be filled.

In cases of massive bone stock loss including loss of anterior and/or posterior columns and in cases of pelvic discontinuity, it may be advisable to use rings or cages in combination with impacted morsellised allograft.

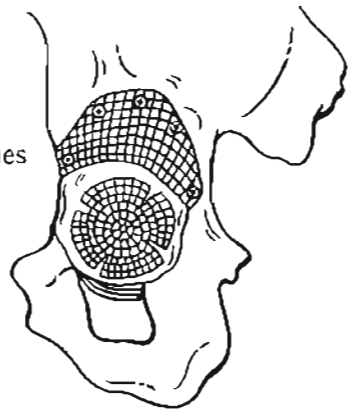


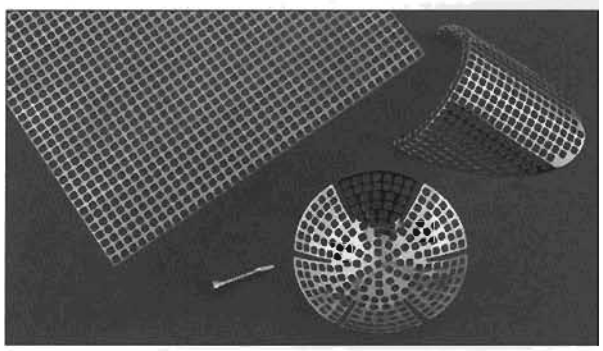
Medial defect



Peripheral segmental defect

Defects closed with metal wire meshes





Preparation of the graft:

Allografts from fresh frozen femoral heads are recommended. Autogenous cancellous chips may be mixed with the allograft if the surgeon so wishes.

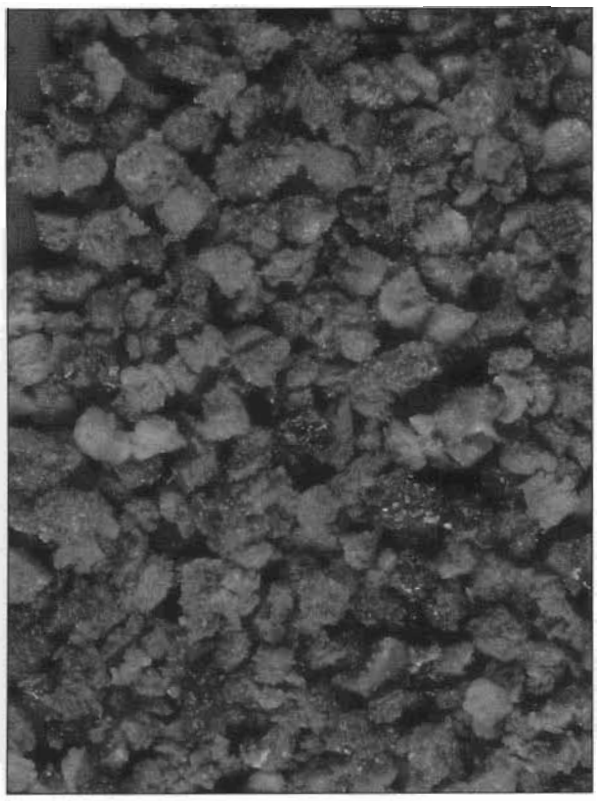
Allograft chips are prepared using rongeurs or by passing the femoral heads through a bone mill which produces chips of substantial size. The more substantial size of the acetabular chip (approx 10mm) is emphasised in contrast to the smaller size of the chips of 4mm each for the femoral reconstruction. Bone slurry is not satisfactory because its consistency is too fluid.

At least 2 femoral heads should be available.

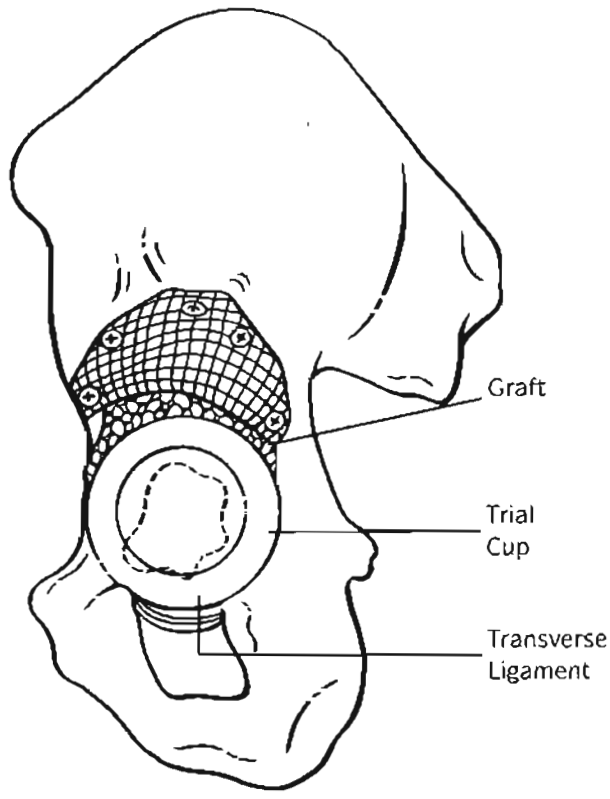
Acetabular Reconstruction:

After rinsing, the acetabulum is packed tightly with chips first in the small cavities, then subsequently layer by layer in the entire socket. The impactors hammer the chips in situ. Use the acetabulum impactors from small to large, add thereafter again bone grafts until a sufficient grade of impaction has been created, which can only be reached by vigorously hammering. The last used impactor should be 2-4mm oversized relative to the planned cup diameter. Care is taken to reconstruct the anatomy of the hip by packing as much chip graft material as necessary until the socket is built up to the height of the transverse ligament (restoration of acetabular form). The impacted graft layer must be at least 5mm thick. For impaction near the rim the small impactors are used in combination with the large impactor.

In this way the entire acetabular hemisphere is finally covered with a layer of impacted allograft chips.



Allograft Chips
(Actual size)



Cement Pressurisation:

The cavity is dried using a gauze swab, if necessary soaked in hydrogen peroxide to provide a clean, dry bed for the bone cement.

The swab is carefully removed and Simplex® cement is introduced into the acetabular cavity in a relatively viscous state.

Typically, using Simplex Cement and with a theatre temperature of 70° F, the cement should be mixed for at least one minute, left to stand for at least one minute and inserted into the cavity at approximately 3-4 minutes.

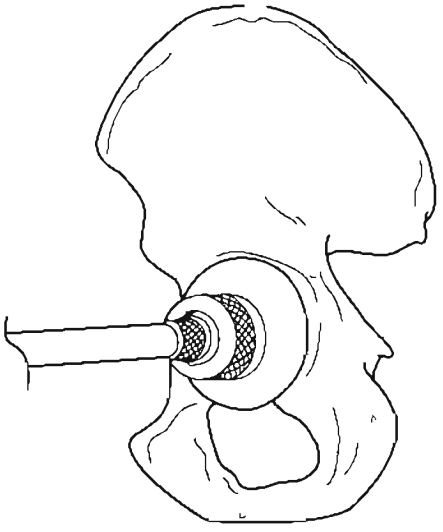
The pressuriser is covered with a gauze swab and a latex sheet, inflated, and then applied to the cement, using considerable pressure to force it into the bone graft. As before, care must be taken to avoid pushing the chips out of the acetabulum and deforming the acetabular rim.

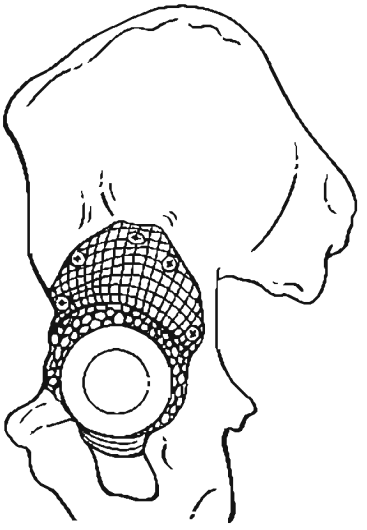
The appropriate size of Howmedica Osteonics all-polyethylene cup is implanted, using the introducer guide rods to ensure correct anatomical alignment. The appropriate size cup is 2-4mm in diameter smaller than the diameter of the last used impactor, creating space for the cement layer.

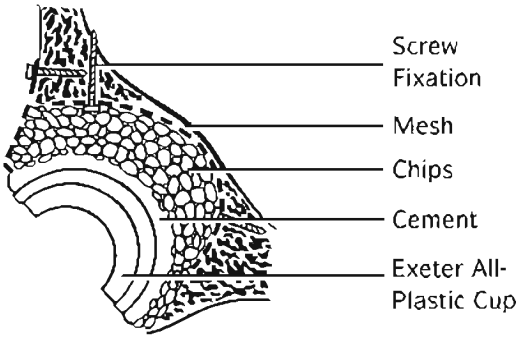
The all-polyethylene cup is held in position with the cup pusher and appropriately sized femoral head until the cement polymerises.

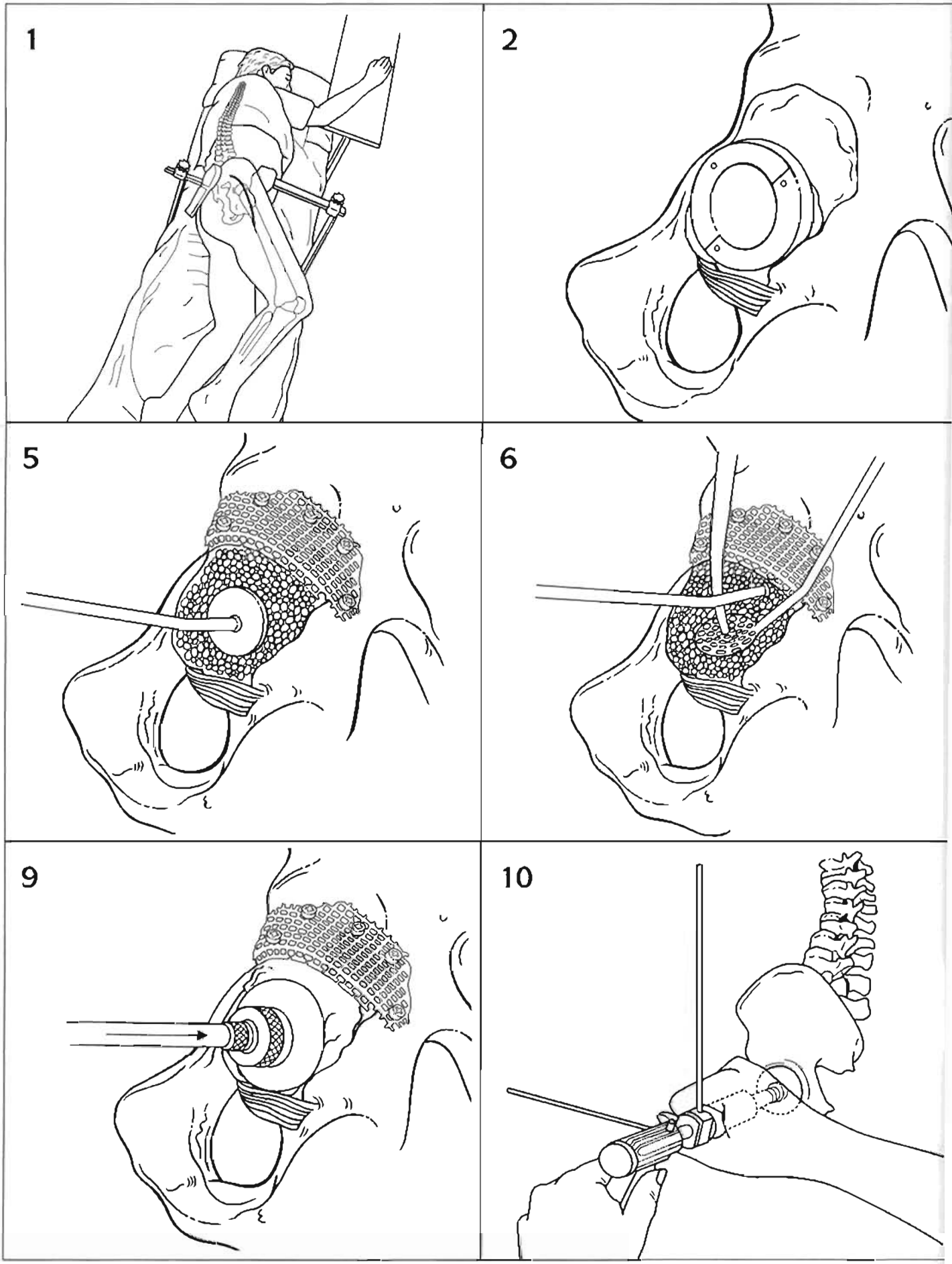
X-ray of acetabular reconstruction

Acetabular Pressuriser





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TECHNIQUE HIGHLIGHTS

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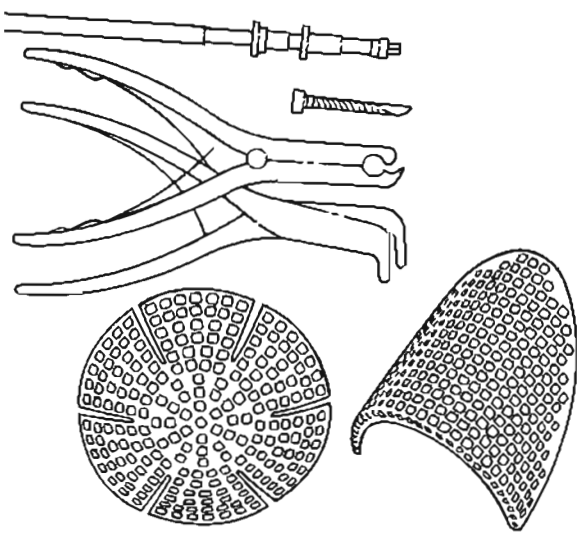

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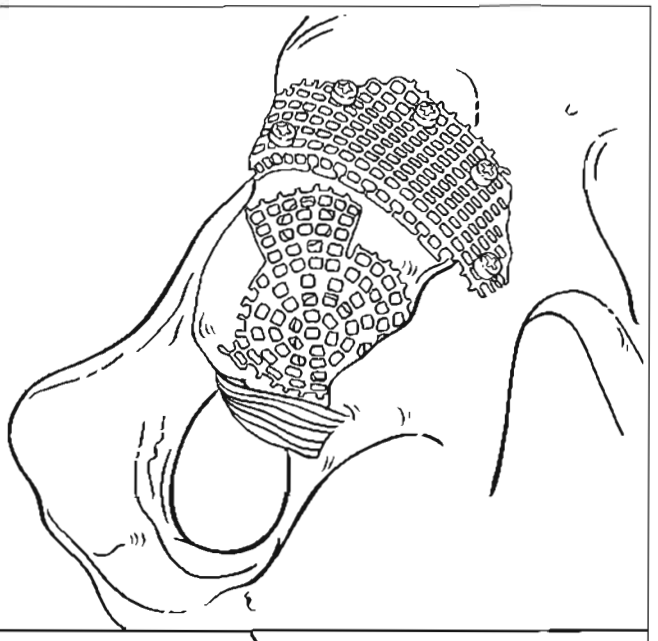

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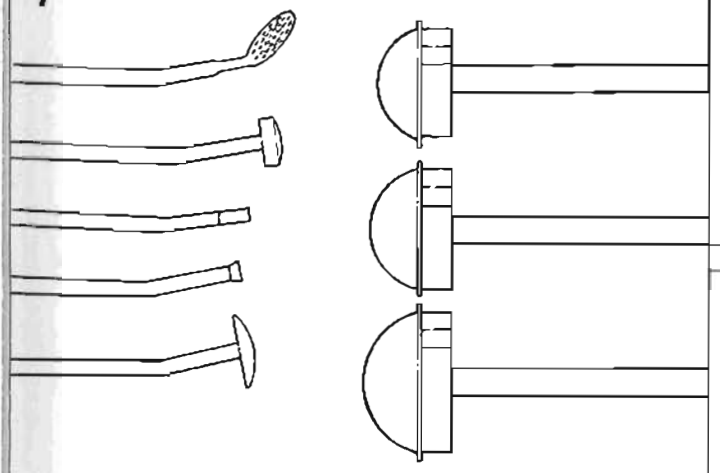

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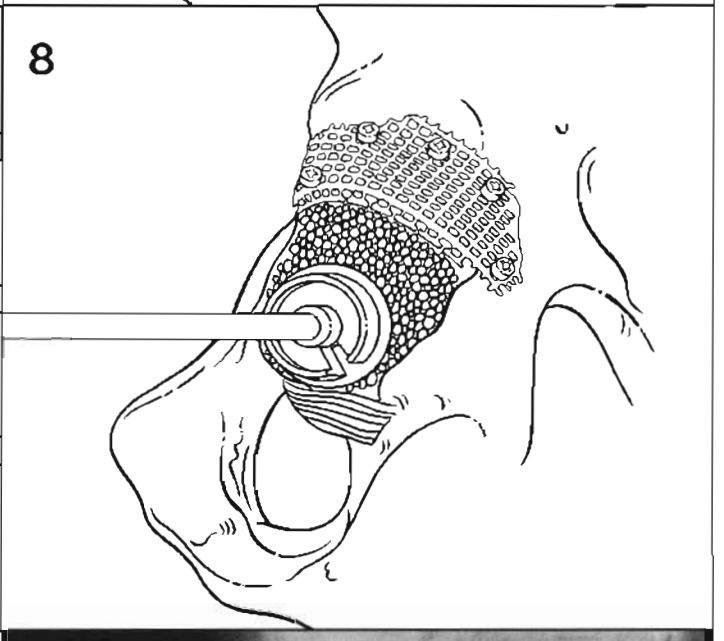

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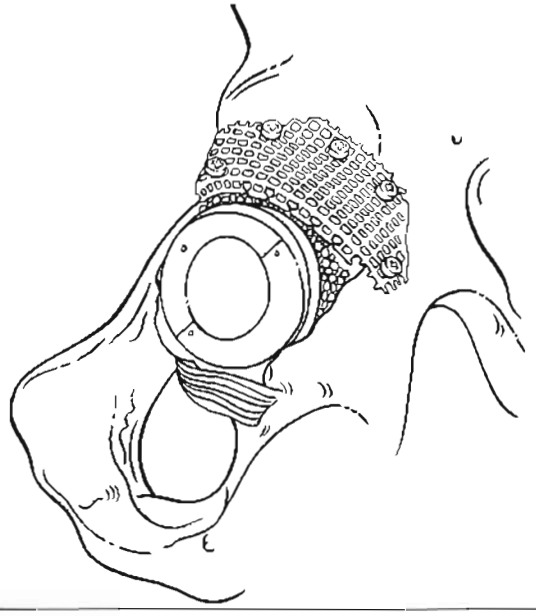

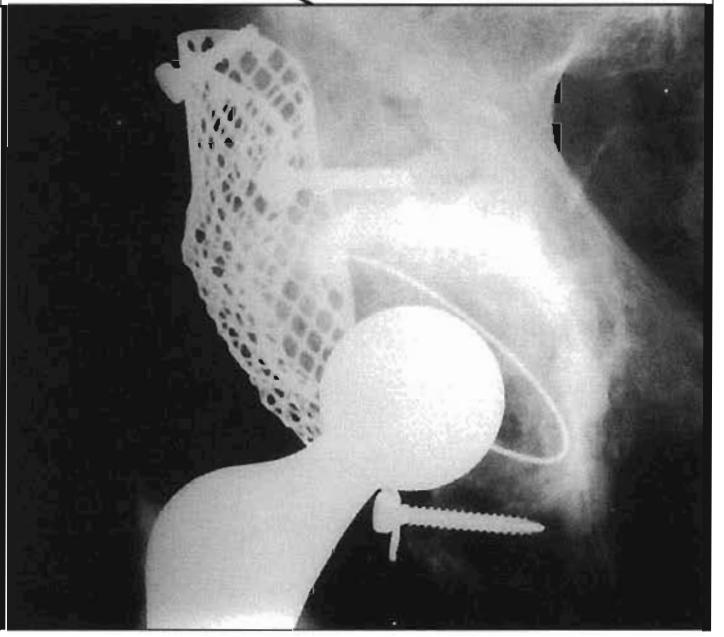

Post-Operative, AP

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Femoral Technique

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