Modern Cementing Technique

Clean bone bed for improved bone cement interface
Optimal pressurization for effective micro-interlock
High and reproducible cement quality
Safe working environment
Modern Cementing Technique

We use the Modern Cementing Technique program for education on bone cements and cementing technique. It combines information and education, ensuring that the principles of Modern Cementing Technique are understood.

The aim is to increase understanding of the following elements of Modern Cementing Technique:
- Bone cement
- Mixing & delivery
- Bone bed preparation
- Pressurization
- Safe working environment

The modern total hip replacement has effectively improved the quality of life for patients with osteoarthrosis of the hip. Modern and reproducible cementing technique implies definite advantages for our patients as well as economical benefits for the health care providers.

A steady increase in the total numbers of total hip replacements has been reported worldwide for a number of years. Therefore a reduction in the number of complications is very attractive. The revision burden varies between 8 and 25 % in different countries.

Improved results
During the last three decades, post-operative long-term results for total hip replacements have improved dramatically. While improvements certainly have been made in both implant design and manufacturing procedures, it is the new standard of surgical and cementing techniques that is mainly responsible for the significant reduction in revision risk.

Micro-interlock
In 1981, Joe Miller introduced the concept of micro-interlock, which is characterized by a stronger bone cement interface. To achieve micro-interlock, the surgeon uses high pressure pulse lavage for cleaning, pressurization devices for adequate cement interdigitation, as well as mixing and collection of cement under vacuum for a reproducible high quality cement. These ingredients comprise the recipe for Modern Cementing Technique.
Modern Cementing Technique

- **Bone cement**
  - Antibiotic loaded bone cement.

- **Clean bone bed**
  - High pressure pulse lavage, brushing.

- **High and reproducible bone cement quality**
  - Mixing and collection of cement under vacuum.

- **Good cement filling**
  - Acetabular and femoral pressurization, distal plug, centralizer.

- **Safe working environment**
  - Closed vacuum mixing and delivery system, protective gloves.

- **Modern Cementing Technique**
  - Reduces the risk of infection in both primary and revision operations.
  - Improves bone cement interface and prevents haemodynamic circulatory changes. A vital step to achieve a good cement fixation and penetration into the cancellous bone.
  - Reduces porosity and improves fatigue strength. Adequate cement filling with cement gun.
  - Improves bone cement interface and yields good stress distribution.
  - Reduces environmental, skin and air exposure to bone cement and monomer fumes.

National Hip Registers

The Swedish Total Hip Replacement Registry has since 1979 been documenting cementing techniques. More than 235,000 patients are included in the register. The register data show significantly improved longevity of implants when Modern Cementing Technique is used. The significant variables are distal plug, pulsatile lavage, proximal seal and vacuum mixing of the cement. Each of these steps has been associated with approximately 20% reduction of revision for aseptic loosening.

The Norwegian Arthroplasty Register started registration of total hip replacements in 1987. In 1994, registration was extended to include insertion of all types of artificial joints. Throughout the registration period 1987 to 2002, information has been registered on about 91,500 hip replacements, 15,000 knee replacements and over 5,000 prostheses in other joints than hip and knee.

The Norwegian Arthroplasty Register shows that the combination of antibiotic-loaded bone cement and systemic antibiotics reduces the risk of revision more than any other regime.
Preoperative planning
A mandatory step prior to surgery, is preoperative planning. Optimal offset and leg length can be planned by using templates.

The need for custom implants and bone transplants can be determined prior to surgery, and decisions can be made on the surgical approach, the size and placement of femoral neck osteotomy, and the size and type of intramedullary plug and stem centralizer.

Positioning of the patient
The patient position should always be checked by the surgeon. It is very important to have the pelvis fixation as rigid as possible. If the pelvis is displaced during manipulation of the hip, there is a high risk of incorrect placement of the acetabular and femoral components.

Incision
Minimal trauma to soft tissues by careful splitting of muscles and partial excision of capsular soft tissue.

Transversal ligament
Remove central osteophytes and be sure to save the transversal ligament in order to obtain optimal pressurization when the cup is cemented.
Acetabulum
Bone bed preparation
- A vital step for cement penetration into the cancellous bone

Reaming
Ream the acetabulum at the anatomical site to the size determined at preoperative planning. Save the part of the subcondral bone. The reaming should be over-sized in order to obtain a 2-3 mm cement mantle.

Anchorage holes
In order to remove as little bone as possible, drill or impact five to eight holes, six mm deep, in the cranial and central parts of the acetabulum. Additional smaller diameter holes can be added in the most cranial parts. These anchorage holes increase the contact area between bone and cement, providing for better fixation.

Brushing
Remove soft tissue and loose cancellous bone with a brush.

Pulse lavage
In order to obtain micro-interlock, use high-pressure pulse lavage and suction repeatedly. Always use a nozzle with front orifices and a splash shield.
Acetabulum
Mixing and Delivery
- Reproducible high quality cement

Bone Cement
Antibiotic-loaded bone cement reduces the risk of infection in both primary and revision operations. High viscosity cements have been shown to offer a lower incidence of revision and aseptic loosening in total hip replacement. For the average patient forty grams of cement is sufficient for the acetabulum.

Cement Mixing
Porosity reduction of cement is best attained by mixing and collection under vacuum. This technique also minimizes exposure to monomer fumes for the staff and precludes direct contact with the bone cement. The cement is mixed and collected in the cartridge under vacuum. The cartridge is then positioned in the cement gun.

Gloves
Protect your hands and prevent contact allergy by using an extra pair of PE gloves. Latex gloves provide no protection from monomer penetration.

Cement Delivery
Deliver the cement into the acetabulum using the cement gun with short nozzle. In order to minimize lamination of the blood, apply the vacuum-mixed cement as a bolus. This requires high viscosity. Delivery time varies depending on type of cement used.
Pressurization has been shown to optimize micro-interlock and enhance bone-cement interface strength. Pressure is applied immediately by using the acetabular pressurizer. Maintain pressure until the cement is sufficiently doughy. Collected data has shown that high pressurization is needed to achieve micro-interlock. This re-affirms the necessity of working in a contained cavity and not removing the transversal ligament.

Introduction and alignment of the cup
Pre-position the cup by hand. Check the alignment using a cup positioner and maintain cup position with a cup holder until the cement has polymerized.

Even cement mantle
You should have 2-3 mm cement mantle around the cup. An even cement mantle means better stress distribution and reduces risk of cement mantle failure.

Protect the cup
Reduction of third body wear is of greatest importance. Use the cup protector in order to prevent cement contamination in the articulating surface.
Femur
Bone bed preparation
- A vital step for cement penetration into the cancellous bone

Reaming
Use a straight reamer to open up the femoral canal. Be sure to open both the posterior and the lateral walls sufficiently. Insufficient reaming will make it impossible to align the femoral stem properly in both planes. Start with the smallest available rasp impactor and increase until the size determined at preoperative planning has been achieved. If necessary, be prepared to use a flexible reamer to enlarge the isthmus.

Distal plug
Determine the plug size by using the special instrument or a flexible reamer. Insert the appropriate distal femoral plug. Place the plug 10 mm distal to the intended level of the tip of the stem. Resorbable biodegradable plugs make the removal during revision surgery unnecessary.

Brushing
Remove soft tissue and loose cancellous bone with a femoral brush. Rotate the brush counter clock-wise to remove debris from femur.

Pulse lavage
Continue the cleaning sequence using the high-pressure pulse lavage system repeatedly in order to facilitate micro-interlock between bone and cement. This will also prevent micro embolization of the marrow contents and significantly minimize circulatory changes. Use a nozzle with side orifices, allowing the pulse lavage to act perpendicular to the bone surface.
Femur
Mixing and Delivery
- Reproducible high quality cement

Bone Cement
60 or 80 grams of cement is normally sufficient for stem fixation.

Cement Mixing
The cement is mixed and collected in the cartridge under vacuum. The cartridge is then positioned in the cement gun.

Pulse lavage
Make a final pulse lavage before injecting the cement. This affords greater cement penetration and enhances cement strength.

Cement Delivery
The cement is delivered in retrograde fashion. This technique eliminates air entrapment during the cement application, preventing porosity in the cement and reduces risk for revision by 20%. Delivery of cement should never be done when the cement is in low viscosity stage.
Femur
Pressurization
- Optimizing micro-interlock

Pressurization
Apply the proximal seal and pressurize the cement. A positive sign of pressurization is marrow extrusion in the greater trochanter (the so-called sweating trochanter sign). Pressurization has been shown to afford greater penetration into the cancellous bone, improve the interlock of bone cement interface and enhance cement strength.

As with the acetabulum, maintain pressure until the cement is sufficiently doughy to withstand bleeding. The time varies depending on type of cement used.

Distal centralizer
Apply the distal centralizer to the stem. The centralizer should be used to avoid varus or valgus malposition of the stem in both planes.

Introduction of the stem
Gently introduce the stem and hold it in place until the cement has polymerized. Introduce the stem with a speed of approximately one centimeter per second, in order to wet the surface of the stem.

Even cement mantle
With the stem in final position, you should have a 2-3 mm cement mantle around the stem and approximately 10 mm between the tip of the stem and the plug. This will yield optimal stress distribution. Finally, reduce the hip.
**Follow-up**
Control your preoperative planning and your cementing technique with the post-operative radiographs. At all radiographic follow-up, take both a frontal and a true lateral exposure in order to determine proper alignment and a uniform cement mantle surrounding both the cup and the stem.

For high-risk patients, a clinical and radiographic follow-up every second year is recommended. For elderly and less active patients, a one year follow-up is sufficient in most cases. If nothing inappropriate shows up, these patients can be left without further check-ups.

**Summary**
The improved results of hip replacement procedures when using Modern Cementing Technique are due to the following:

- a clean bone bed for good fixation and effective micro-interlock
- a high and reproducible bone cement quality
- good cement filling and greater cement penetration

**Cost Savings**
The use of antibiotic-loaded cement in combination with systemic antibiotic will further reduce the risk for revision and will be a cost-effective strategy.

The Swedish Total Hip Registry have contributed to a significant cost reduction for the health care system. The savings has been estimated to 14 million US dollars annually over the past ten years.

The outcome of Total Hip Replacements has improved significantly from Modern Cementing Technique. Research must continue, however, and training and education on cementing technique is of utmost importance.

In addition, the use of a closed vacuum mixing system results in a safer working environment.

This brochure is produced in cooperation with

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There is always more to learn

Within the orthopedic community there is increasing focus on Modern Cementing Technique. New studies and publications have dramatically increased our knowledge and awareness of the importance of bone cement and cementing techniques. The Cementing University is a forum for training and education. It aims to spread knowledge about Modern Cementing Technique and to emphasize the importance of bone cement and cementing techniques.

Bone cement and cementing systems by Biomet

Decades of experience in bone cement and cementing systems has allowed us to help in the treatment of over 10 million patients worldwide. Every minute, an operation is completed with products from Biomet Cementing Technologies AB.

Proven products for bone cement, mixing and delivery, pressurization and bone bed preparation make up one of the most complete Modern Cementing Technique concepts available on the market today.

For contact details to local distributors, please visit our website www.bonecement.com.