MODERN CEMENTING TECHNIQUE - KNEE

IMPLANT

CEMENT

BONE

ZIMMER BIOMET
Your progress. Our promise.
Modern Cementing Technique Knee (MCT Knee) addresses implant loosening and the objective is to provide long term implant stability in knee arthroplasty. It is based on scientific data,1-26 and findings by Zimmer Biomet.27,41*

The crucial factors in knee arthroplasty to achieve long term implant stability are to secure a strong bond, and optimal interfaces, between implant-cement and cement-bone. To address the risk of de-bonding and thus loosening of the implant follow the established MCT concept below:

**Implant-Cement Interface**
- Deliver the sticky cement with a cement gun and appropriate delivery devices, such as knee nozzles
- Apply the sticky bone cement to implant first, as early as possible (no waiting phase)4,27,41*
- Help to prevent implant-cement interface contamination by implementing a “no-touch” policy 4,27,41*

**Bone Cement**
- Use a bone cement with good mechanical and consistent handling properties
- Mix and collect the cement under vacuum to help reduce cement porosity and to improve mechanical strength8,28

**Cement-Bone Interface**
- Perforate cancellous bone if dense or sclerotic24*
- Clean with high pressure pulsatile lavage repeatedly until clear fluid is received in the return line29-31
- Deliver the doughy bone cement with a cement gun and appropriate delivery devices, such as knee nozzles and pressurize
- Deliver bone cement into tibial stem hole to achieve full cementation21-23

*Laboratory testing is not necessarily indicative of clinical performance.
Help to secure a strong bond and optimal interfaces between Implant-Cement and Cement-Bone
Modern Cementing Technique Knee Key Surgical Steps

**Bone Bed Preparation**
Cleanse all cement-receiving bone surfaces thoroughly using high pressure pulse lavage of the entire resected bone surface in order to ensure solid cement fixation.29-31

Clean repeatedly until clear fluid is received in the return line to reduce the amount of debris, blood, bacteria and fat.29-31

**Tibia**
In sclerotic bone, supplementary anchorage holes may increase the contact area between bone and cement, providing enhanced fixation.

Curette cysts and remove pericystic sclerotic walls. Depending on cyst diameter, patient age and activity level, fill bone defects with bone cement or particulate bone graft.

**Femur**
Contained defects can be grafted with bone taken from the cut surfaces.32

In sclerotic bone, drill supplementary anchorage holes.

Perform thorough lavage of all surfaces.

Before cement application, bone surfaces should be kept dry, including the posterior aspect of the femoral condyles.

**Patella**
If the resected bone surface is hard and sclerotic, supplementary anchorage holes may be drilled.
Vacuum Mixing of Bone Cement

Mix the bone cement in a closed vacuum mixing system to reduce micro and macro pores and decrease the risk of cracks in the cement.5-7,9,32

40g of bone cement is normally sufficient for Total Knee Replacement (TKR).

The handling properties of the bone cement are highly dependent on the temperatures of the cement and the operating room. Higher temperatures make for a shorter working phase and a faster setting time.

High viscosity bone cement like Refobacin® Bone Cement R can be pre-chilled if a longer working phase is required.

Note: Inclusions of blood and laminations in the cement mass reduces the mechanical strength of the resulting cement mantle.34,35

Delivery of Bone Cement

Start with applying the sticky bone cement on implant as early as possible (no waiting phase).

Deliver the bone cement with a cement gun. Use the flat knee nozzle and apply the sticky bone cement to the implant.

Prevent implant-cement interface contamination by implementing a “no-touch” policy.
Implanting Final Components
The components may be cemented sequentially or simultaneously.

**Tibia**

**Delivery and Pressurization of Bone Cement on Bone**
Deliver the doughy bone cement to a clean, dry bone bed following pulse lavage.

Use a cement gun and an adequate nozzle in order to minimize the risk of air and blood entrapment and achieve sufficient pressurisation. Apply bone cement on bone and pressurize the cement, striving for penetration of 3-4 mm to help ensure optimal fixation and stress distribution.

**Insertion Components**
To facilitate insertion, flex the knee and externally rotate the tibia. Press down on the posterior portion of the tibial component first to force excess cement anteriorly. Then press down on the anterior portion of the component with the impactor pad assembled to the Tibial Plate Impactor. Impact the tibial base plate moving from posterior to anterior until fully seated.

Remove any excess bone cement from posterior aspect of the tibia using a curved tonsile/hemostat.
**Femur**

**Delivery and Pressurization of Bone Cement on Bone**

Deliver the doughy bone cement to a clean, dry bone bed following pulse lavage.

Apply a layer of bone cement over the entire bone-opposing surface of the femoral component using a cement gun and an adequate nozzle.

Pressurize the cement, striving for penetration of 3-4 mm to help ensure optimal fixation and stress distribution.

Avoid contamination of the implant-cement interface.

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**Insertion Components**

The components are inserted and driven into position with impactors, followed by trial liner insertion and compression with the leg lift method.

After polymerization remaining cement flakes at implant peripheries are removed.

Bone cement debris is removed by high pressure pulse lavage.
**General Clinical Problem in Knee Arthroplasty: Tibial Loosening**

Tibial loosening between cement and implant is not limited to any particular cement brand or tibial component design. An important factor is the cementation technique.

- According to the Millenium Research Group, the 2016 projections for knee revisions in 9 markets were 175,000 (Germany, UK, France, Italy, US, China, India, Japan and Brazil).\(^\text{36}\)

- Aseptic loosening of cemented tibial components remain a major cause of failure. It is shown in literature to account for 24% of all knee revisions.\(^\text{3}\)

- Micro motion at the implant-cement or cement-bone interface can generate wear particles.\(^\text{37}\)

**Cement Application**

Optimized micro-mechanical interlock can be achieved with early applied sticky bone cement to a non-contaminated implant surface.\(^\text{4,27,41**}\)

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* Bench test results not necessarily indicative of clinical performance.
** Laboratory testing is not necessarily indicative of clinical performance.
Independent Lab Study with Triathlon® Tibial Trays and Simplex® and PALACOS® Bone Cements4*

Conclusions

• Under laboratory conditions, a clean tibial tray-cement interface is strong, but much stronger when the keel is cemented.4

• Earlier application of the cement to metal increases bond strength while later application reduces bond strength.4

• Fat contamination of the tibial tray-cement interface reduces bond strength, but application of cement to the underside of the tibial tray prior to insertion substantially mitigates this.4

Solutions for Modern Cementing Technique Knee

Deliver the cement with a cement gun and appropriate delivery devices, as applicable. Use the flat knee nozzle and apply the bone cement to implant first, as early as possible in the sticky phase.

*Lab test results not necessarily indicative of clinical performance.
Bone Cement

Polymethyl methacrylate (PMMA) bone cements fill the space between prostheses and bone, transmitting and evenly distributing loads. The main considerations are:

- Good mechanical properties
- Consistent handling properties

Mixing and Collection Under Vacuum

Mixing and collecting the cement under vacuum reduces both micro and macro pores.8-10,33

- Improved cement strength and fatigue life7,11*
- Lower risk of aseptic loosening due to cracks7-10
- Delivery of reproducible results
- Less exposure to monomer fumes11,42*

* Lab test results not necessarily indicative of clinical performance.
Factors Influencing Bone Cement Handling Characteristics

Temperature
- Cement temperature
- Body temperature
- OR temperature
- Storage temperature

Time
- From storage to mixing
- From mixing to application
- Application time
- Setting time
- Start the clock immediately when the powder and liquid meet

Mixing Method
- Vacuum (closed system)
- Bowl (open air)

Type of Cement
- Low viscosity
- Medium viscosity
- High viscosity

Handling
- Vigorous kneading of the cement may speed up the polymerization process
- Use the right proportion of powder and liquid

Improved Working Environment
- Use an extra pair of PE gloves
- A closed system minimizes monomer fumes and skin contact
- Use a combined system for mixing and delivery

Higher temperature = faster setting time

Test – get to know your cement

Read relevant information

Read relevant information

Standardize your cement handling

Rubber gloves do not protect against monomer
Cement-Bone Interface

**Bone Bed Preparation**

Preparation of the bone bed with a pulsative lavage system, like the Pulsavac® Plus Wound Debridement System, helps to ensure solid cement fixation. Clean repeatedly until clear fluid is received in the return line to reduce the amount of debris, blood, bacteria and fat.29-31

- To obtain proper cement penetration and fixation into the cancellous bone30
- Reduce the risk for revision due to aseptic loosening3,18
- Reduce the risk for fat embolism29

**Delivery**

- A uniform, deep bone cement mantle helps to ensure optimal fixation and stress distribution14,15
- Application with a cement gun and an appropriate nozzle on both tibia and femur16-19
- Delivery to a clean, dry bone bed following pulse lavage12,13

**Pressurization**

- Increases penetration into the cancellous bone and reduces cement porosity20
- Improves interface between bone and cement7
- Better stress distribution7
Solutions for Modern Cementing Technique Knee

Optipac® Vacuum Mixing System
A closed vacuum mixing system, pre-packed with bone cement

Proven, Strong, Safe

- On the market since 2008 and based on Optivac® Technology since 1993
- Designed to improve cement fatigue life by mixing and collection under vacuum
- Featuring SoftPac™ Technology ensures no breaking of glass ampoules.
- Standardized and reproducible method, improved cement quality
- Minimizing exposure to monomer fumes
- No direct contact with bone cement during mixing and delivery

Optivac® Vacuum Mixing System
Designed for mixing and collection under vacuum, Optivac Vacuum Mixing System reduces both microporosity and macroporosity

- Designed to improve cement strength and fatigue life
- On the market since 1993
- Unmatched in documentation

Refobacin® Bone Cement

- High viscosity cement
- Green color of cement allows for easy recognition during surgery
- Reliable mechanical performance based on international standard laboratory testing.

*Laboratory testing is not necessarily indicative of clinical performance.
**In published articles and lab reports
## Ordering Information

### Optipac Refobacin® Bone Cement R

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**Mixing & Delivery and Bone Bed Preparation**

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References

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