MODERN CEMENTING TECHNIQUE - KNEE

IMPLANT

CEMENT

BONE

ZIMMER BIOMET
Your progress. Our promise.®

Modern Cementing Technique Knee for improved clinical outcome[1,2]

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

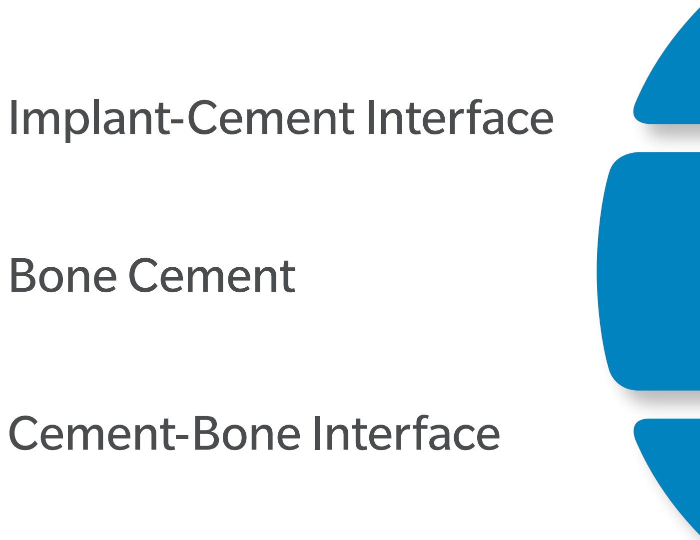
- Deliver the sticky cement with a cement gun and appropriate delivery devices, such as knee nozzles
- Apply the sticky bone cement to implant first, as early as possible (no waiting phase)[4,27,41*]
- Help to prevent implant-cement interface contamination by implementing a "no-touch" policy[4,27,41*]

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 strength[8,28]

Cement-Bone Interface

- Perforate cancellous bone if dense or sclerotic[24*]
- Clean with high pressure pulsatile lavage repeatedly until clear fluid is received in the return line[29-31]
- 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 cementation[21-23]



*Laboratory testing is not necessarily indicative of clinical performance.

Help to secure a strong bond and optimal interfaces between Implant-Cement and Cement-Bone

IMPLANT

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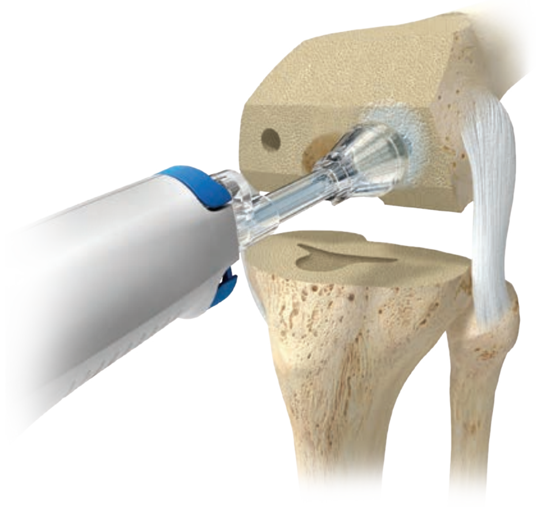
Modern Cementing Technique Knee Key Surgical Steps

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]

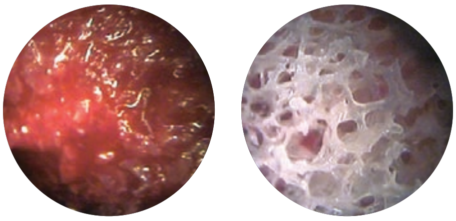
Clean repeatedly until clear fluid is received in the return line to reduce the amount of debris, blood, bacteria and fat.[29-31]



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.



Before After

Femur

Contained defects can be grafted with bone taken from the cut surfaces.[32]

In sclerotic bone, drill supplementary anchorage holes.

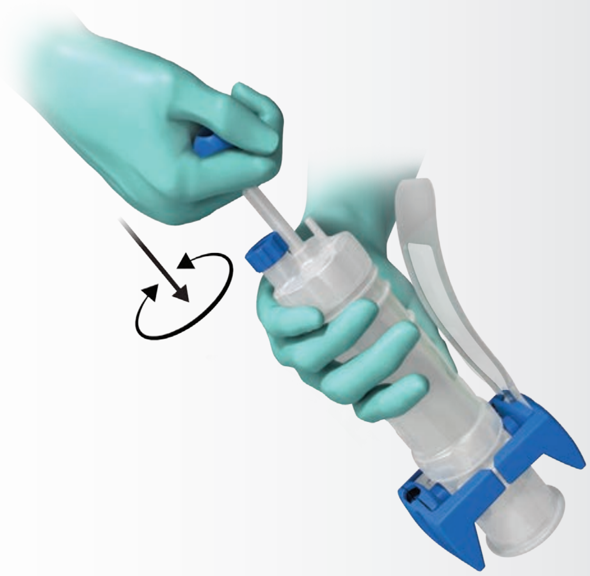
Perform thorough lavage of all surfaces.

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]

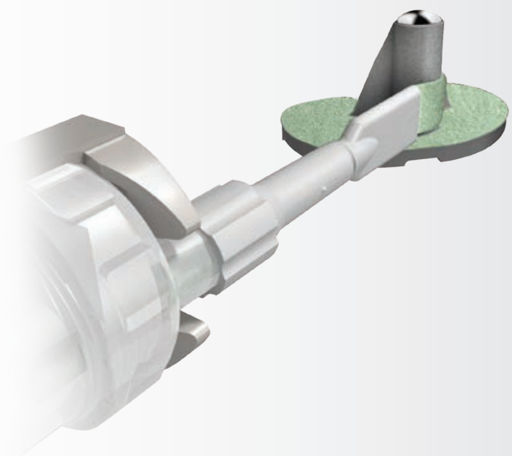
40g of bone cement is normally sufficient for Total Knee Replacement (TKR).

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.

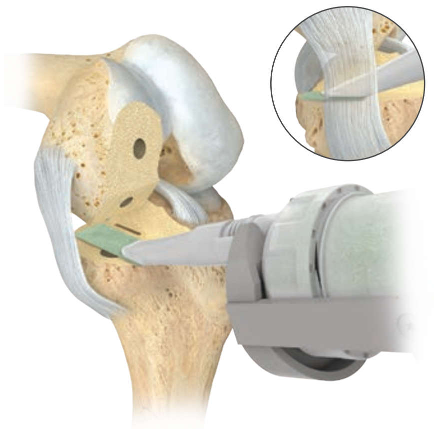
Tibia

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.

Total Knee Replacement

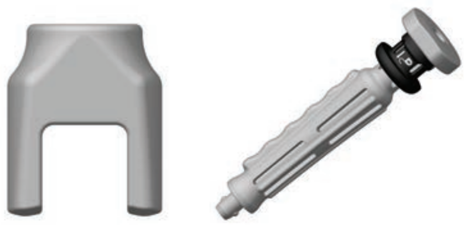


Partial Knee Replacement

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

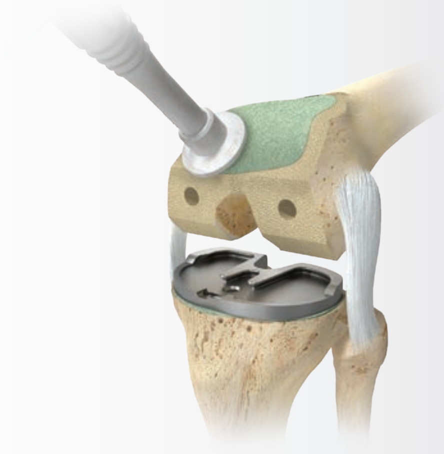
Delivery and Pressurization of Bone Cement on Bone

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

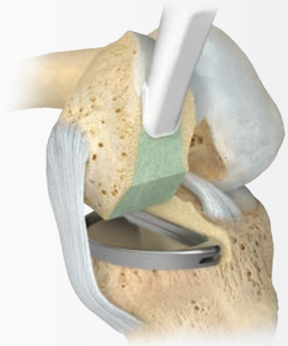
Apply a layer of bone cement over the entire bone-opposing surface of the femoral component using a cement gun and an adequate nozzle.

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.



Total Knee Replacement



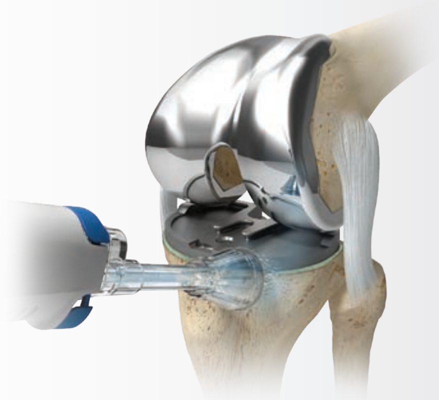
Partial Knee Replacement

Insertion Components

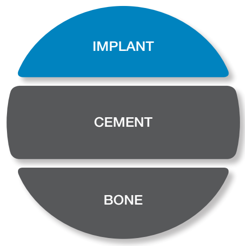
The components are inserted and driven into position with impactors, followed by trial liner insertion and compression with the leg lift method.

After polymerization remaining cement flakes at implant peripheries are removed.

Bone cement debris is removed by high pressure pulse lavage.



Implant - Cement Interface



General Clinical Problem in Knee Arthroplasty: Tibial Loosening

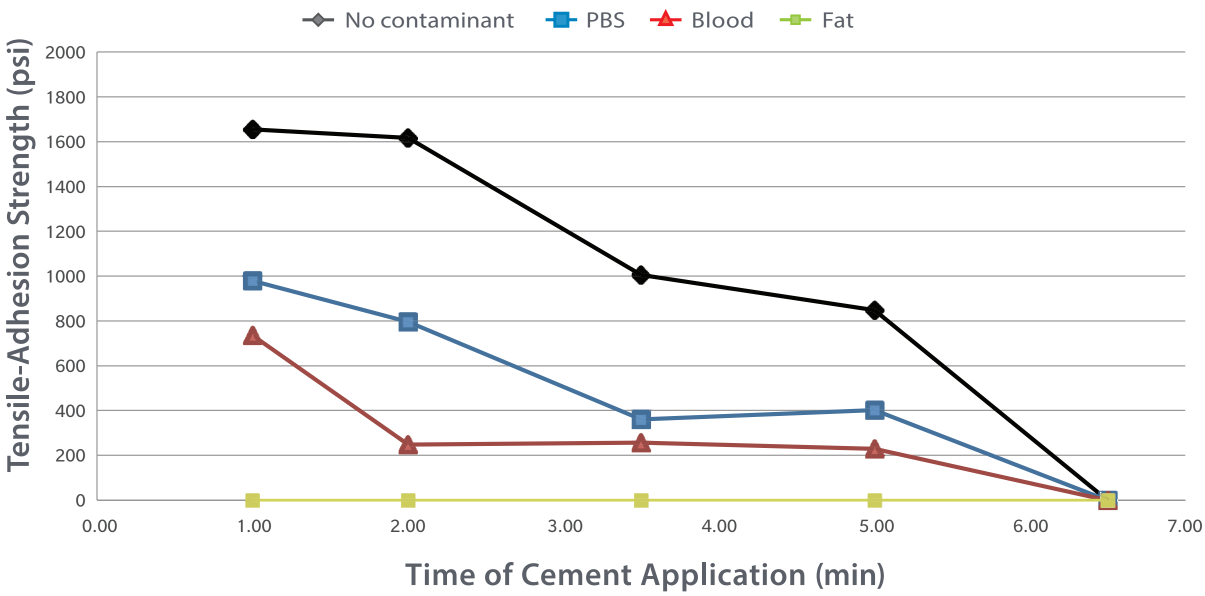
Tibial loosening between cement and implant is not limited to any particular cement brand or tibial component design. An important factor is the cementation technique.

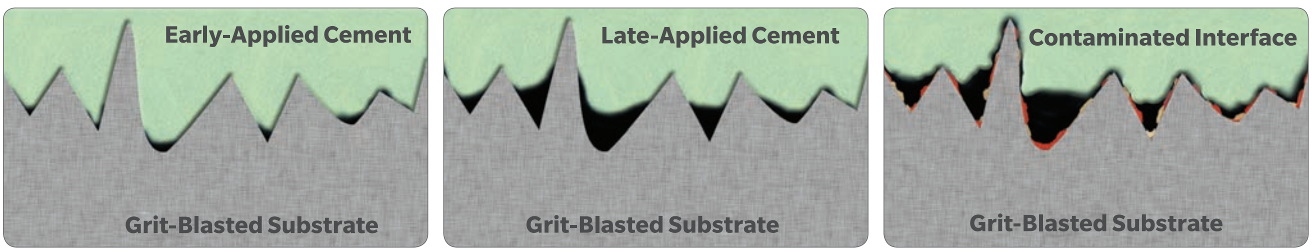
- According to the Millenium Research Group, the 2016 projections for knee revisions in 9 markets were 175,000 (Germany, UK, France, Italy, US, China, India, Japan and Brazil).[36]
- Aseptic loosening of cemented tibial components remain a major cause of failure. It is shown in literature to account for 24% of all knee revisions.[3]
- Micro motion at the implant-cement or cement-bone interface can generate wear particles.[37]

Cement Application

Optimized micro-mechanical interlock can be achieved with early applied sticky bone cement to a non-contaminated implant surface.[4,27,41**]

Tensile-Adhesion Strength of Refobacin® Bone Cement R on 30 grit blast CoCr[41*]





*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 Cements[4] *

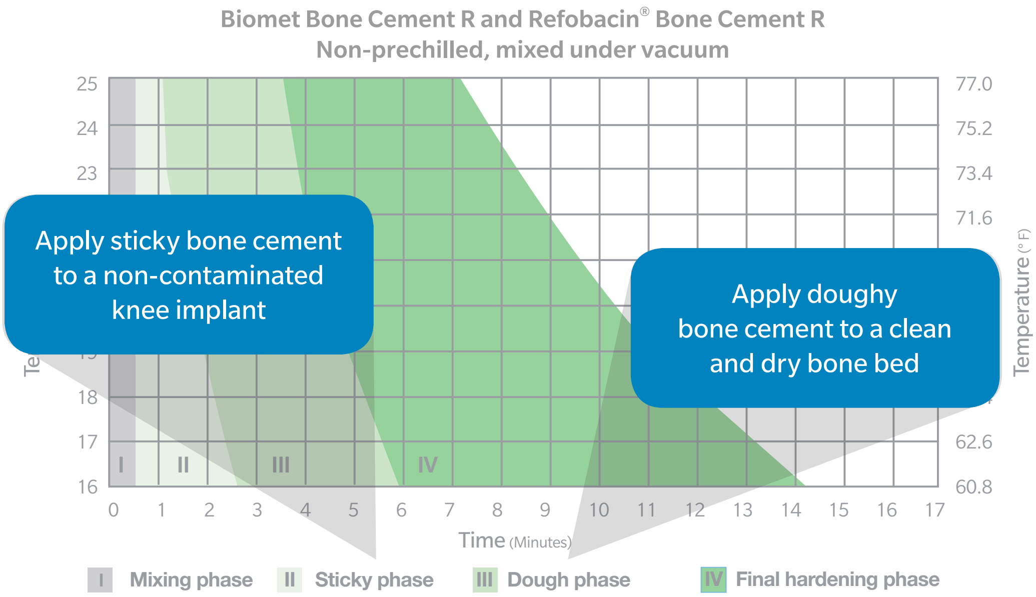
Conclusions

- 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

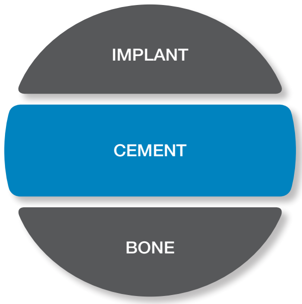
Deliver the cement with a cement gun and appropriate delivery devices, as applicable.
Use the flat knee nozzle and apply the bone cement to implant first, as early as possible in the sticky phase.

Flat Knee Nozzle used for early application on implant



*Lab test results not necessarily indicative of clinical performance.

Bone Cement



Bone Cement

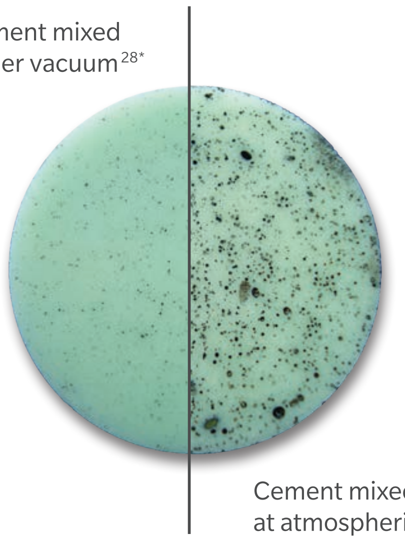
Polymethyl methacrylate (PMMA) bone cements fill the space between prostheses and bone, transmitting and evenly distributing loads. The main considerations are:

- 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 life[7,11*]
- Lower risk of aseptic loosening due to cracks[7-10]
- Delivery of reproducible results
- Less exposure to monomer fumes[11,42*]



Optipac® Vacuum Mixing System

* Lab test results not necessarily indicative of clinical performance.

Factors Influencing Bone Cement Handling Characteristics

Temperature

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

Higher temperature = faster setting time

Time

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

Test – get to know your cement

Mixing Method

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

Read relevant information

Type of Cement

- Low viscosity
- Medium viscosity
- High viscosity

Read relevant information

Handling

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

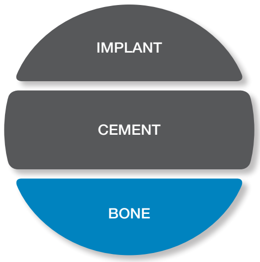
Standardize your cement handling

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

Rubber gloves do not protect against monomer

Cement-Bone Interface



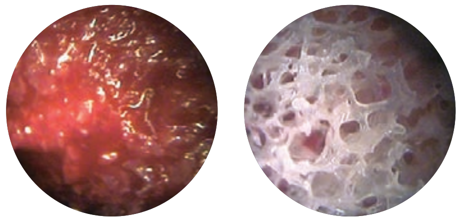
Bone Bed Preparation

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 bone[38]
- Reduce the risk for revision due to aseptic loosening[3,18]
- Reduce the risk for fat embolism[29]

Delivery

- A uniform, deep bone cement mantle helps to ensure optimal fixation and stress distribution[14,15]
- Application with a cement gun and an appropriate nozzle on both tibia and femur[16-19]
- Delivery to a clean, dry bone bed following pulse lavage[12,13]



Before After

Pressurization

- Increases penetration into the cancellous bone and reduces cement porosity[20]
- Improves interface between bone and cement[7]
- Better stress distribution[7]

23 Degree Pressurizing Nozzle used to apply bone cement and pressurize

Cementation Nozzle used to apply bone cement and pressurize

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[8-10]
- Featuring SoftPac™ Technology ensures no breaking of glass ampoules.
- Standardized and reproducible method, improved cement quality[9]
- Minimizing exposure to monomer fumes[11,42]*
- No direct contact with bone cement during mixing and delivery

Optipac | SINCE 2008

Optivac® Vacuum Mixing System

Designed for mixing and collection under vacuum,
Optivac Vacuum Mixing System reduces both microporosity and macroporosity[8-10]

- Designed to improve cement strength and fatigue life[8-11,33]
- On the market since 1993
- Unmatched in documentation[8-11,33]* **

Refobacin® Bone Cement R

- High viscosity cement
- Green color of cement allows for easy recognition during surgery
- Reliable mechanical performance based on international standard laboratory testing.[39,40]

*Laboratory testing is not necessarily indicative of clinical performance.

**in published articles and lab reports

Ordering Information

Optipac Refobacin® Bone Cement R

Product	Description	Part Number	Units/Box
	Optipac Knee Refobacin® Bone Cement R	4709500392-3	8
	Optipac 40 Refobacin® Bone Cement R	4710500394-3	8
	Optipac 60 Refobacin® Bone Cement R	4711500396-3	8
	Optipac 80 Refobacin® Bone Cement R	4712500398-3	8
	Optipac Hip Set (40 + 80) Refobacin® Bone Cement R	4740500394-3	4

Optipac Refobacin® Plus Bone Cement

Product	Description	Part Number	Units/Box
	Optipac Knee Refobacin® Plus Bone Cement	4719502082-3	8
	Optipac 40 Refobacin® Plus Bone Cement	4720502083-3	8
	Optipac 60 Refobacin® Plus Bone Cement	4721502084-3	8
	Optipac 80 Refobacin® Plus Bone Cement	4722502117-3	8

Refobacin® Bone Cement R

Product	Description	Part Number	Units/Box
	Refobacin® Bone Cement R 1x20	3003920001-3	20
	Refobacin® Bone Cement R 2x20	3003920002-3	20
	Refobacin® Bone Cement R 1x40	3003940001-3	20
	Refobacin® Bone Cement R 2x40	3003940002-3	20
	Refobacin® Bone Cement R 1x60	3003960001-3	12

Biomet Bone Cement R

Product	Description	Part Number	Units/Box
	Biomet Bone Cement R 1 x 40	3035890011-3	20
	Biomet Bone Cement R 2 x 40	3035890022-3	20

Refobacin® Plus Bone Cement

Product	Description	Part Number	Units/Box
	Refobacin® Plus Bone Cement 1x20	3020820401-3	20
	Refobacin® Plus Bone Cement 2x20	3021180001-3	20
	Refobacin® Plus Bone Cement 1x40	3020830401-3	20
	Refobacin® Plus Bone Cement 2x40	3021170001-3	20
	Refobacin® Plus Bone Cement 1x60	3020840401-3	12

Refobacin® Revision

Product	Description	Part Number	Units/Box
	Refobacin® Revision 1x40	3011630001-3	20

Mixing & Delivery and Bone Bed Preparation

Product	Description	Part Number	Units/Box
	Optivac S	4161	10
	Optivac M	4160	10
	Optivac L	4152	10
	Optigun™	4193	1
	Optigun Ratchet	4195	1
	Pulsavac® Plus Fan Spray Kit	00-5150-475-00	10
	Knee Cementation Nozzle	4312	10
	23-Degree Pressurizing Nozzle	4148	5
	Knee Nozzle	4146	5

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Notes

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