

BONE CEMENT

Powder Polymer (PMMA) 88%

Barium sulphate 10%

Initiator: Benzoyl Peroxide 2%

Liquid Monomer (MMA) 97%

N,N' dimethyl toluidine (accel) 2.6%

Hydroquinone (Polymerisation inhibitor)

Bone cement Structure CH₃-CH₃C-C=O-CH₃O (out of 4: 3 = CH₃)

Sterilization Powder Gamma radiation

Liquid Ultra filtration

CEMENT TECHNIQUE

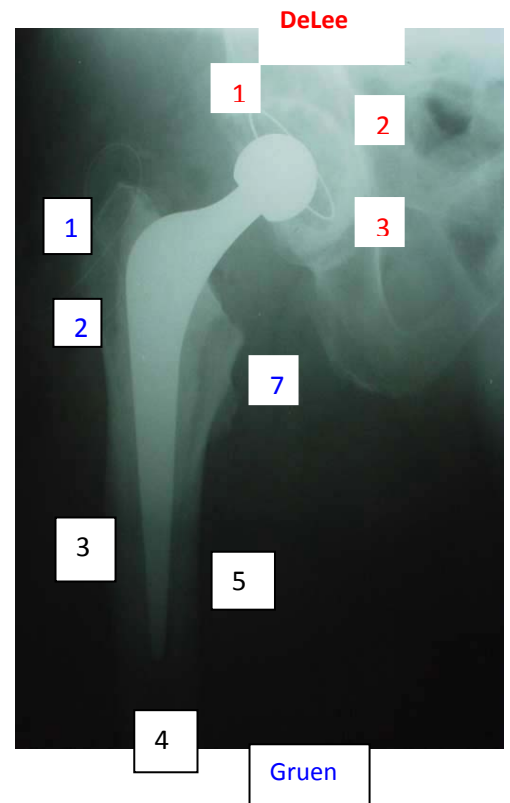
I Generation	II Generation	III Generation
Finger Packing	Cement Gun	Cement Gun
-	cement Restrictor	cement Restrictor
-	Pulsatile lavage	Pulsatile lavage
-	Brush and dry	Brush Dry
-	-	Centraliser for stem
-	-	Vacuum mix
-	-	Pressuriser
-	-	Precoat and rough surface

Ideal cementing

More than 2mm cement mantle in all 7 Gruen's zone

Stems filling with cement should be at least $\frac{1}{3}^{\text{rd}}$ of the canal

There are 7 zones [Gruen] around the stem and three around the Cup [DeLee].



Stem migration

Exeter migrates distally 3 times faster than the Charnley prosthesis

Normal subsidence is 1 mm at one year and 1.2 mm at 2yrs.

Loosening with Matt finish was 4 times that of polished stem

Factors for stem loosening

1. Poor cement technique and poor cement mantle
2. Varus stem $> 5^{\circ}$
3. Thicker stems lead to higher cement stress.
4. Highest stress is in Zone V and VII
5. Vacuum suction cement mix: high failure (Sweedish study)
6. Polished and matt finish: Polish is better
7. Type of cement (Simplex better than CMW)
8. Precoated with methacrylate: High failure

Results

15 yrs survival: 90% for the stem and 65% for the cup

CEMENT SETTING

Dough time	Does not stick to the glove 2-3 minutes
Working time	4-8 minutes Dough time till cement going stiff
Insertion time	4 minutes Insertion time Early or delay in insertion weakens the cement
Setting time	Dough time and working time 8-10 minutes Liberates: 12-14 kcal/100g

FACTORS AFFECTING CEMENT SETTING

1. Rapid mix: shortens dough time
2. High room temperature: shorten dough and setting time
3. High humidity: decreases setting time

REACTION

Polymerization	Double bond becomes single Carbon bond.
Thermal necrosis	60°C
In vivo the temperature	40°C
Low viscosity	Cement can be used in the gun (cement take longer time to be doughy)
Vacuum mix	50% less in porosity Not proved this technique is better in Swedish

ANTIBIOTICS AND CEMENT

Addition of antibiotic does not weaken the cement more than 4%

Trend is to use this cement even in Primary joints

TOXICITY

1. Irreversible cardiac arrest: Monomer (usually within 60 sec)
2. Fat embolisation: High chance during femoral stem introduction

HOW TO IMPROVE STRENGTH OF CEMENT

1. Limit mixing time to 90 sec
2. Dry field (presence of blood reduces strength to 30%)
3. Cement gun (increase strength by 30%)
4. Pressurization: 2 atmospheres of pressure increase strength by 10%
5. Cement mantle thickness 3 mm [There should not be any direct contact of prosthesis with bone]

MECHANISM IT WORKS

1. Cement is not glue but fill all the Interstices
2. Cement improve the stress distribution in the bone from prosthesis
3. Cement has a poor notch property: do not use prosthesis with sharp border
4. Cement is strong in compression than tension

GRADING OF CEMENT [BARRACK]

- A Medullary cavity completely filled with cement
- B Slight radiolucent at the bone cement interface
- C Radiolucency >50%
- D Radiolucency 100% in any projection including absence of cement distal to the stem tip

Overall femoral Design

Spectron: Medial collar, Matt finish excellent result

Exeter, CPT: Stainless Steel, polished non-collar is better

