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ORIGINAL ARTICLE

Tibial cleaning method for cemented total Knee Arthroplasty- A clinical study

Rakesh Thakkar[1], Mohd Sameer Qureshi[2]

[1]Assistant professor, Department of Orthopedics, Chandulal Chandrakar Memorial Medical College , Durg, Chhattisgarh 490024;
[2]Senior Resident, Department of Orthopedics, Chandulal Chandrakar Memorial Medical College , Durg, Chhattisgarh 490024

ABSTRACT:
Background: Major joint arthroplasty is undoubtedly one of the surgical success stories of modern times. The number of primary knee arthroplasties performed annually increased exponentially over the last half of the 20th century. The present study determined optimal cleaning method in terms of cement-bone contact at the tibial resection surface. **Materials & Methods:** 30 tibial plateau specimens obtained during surgery for knee resurfacing arthroplasty of both genders were cleaned in four different ways before cementing no cleaning (group I), manual syringe irrigation (group II), fracture brush cleaning (group III) and pulsatile jet-lavage (group IV). **Results:** Out of 30 patients, males were 18 and females were 12. The mean bone-cement contact distance in group I was 13.9 mm, in group II was 19.2 mm, in group III was 20.4 mm and in group IV was 31.4 mm. The mean cement penetration was 1.26 mm in group I, 1.95 mm in group II, 1.76 mm in group III and 3.00 mm in group IV. The difference was significant (P< 0.05). **Conclusion:** Better results were found with pulsatile jet-lavage before cementing tibial components in knee arthroplasty.
Key words: Knee arthroplasty, Pulsatile jet-lavage, Tibia.

Corresponding Author: Dr. Rakesh Thakkar, Assistant professor, Department of Orthopedics, Chandulal Chandrakar Memorial Medical College , Durg, Chhattisgarh 490024

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INTRODUCTION

Major joint arthroplasty is undoubtedly one of the surgical success stories of modern times. The number of primary knee arthroplasties performed annually increased exponentially over the last half of the 20th century and increased between 16% and 44% during the first 5 years of the 21st century. The history of total knee arthroplasty began back in 1860, when the German surgeon Themistocles Gluck implanted the first primitive hinge joints made of ivory.[1]
The knee is a synovial joint with three articular compartments: medial, lateral, and patellofemoral.[2] The most common type of TKA replaces the femoral articular surfaces with a metal bicondylar component, the tibial articular surfaces with a metal tray carrying a polyethylene bearing surface, and the patellar articular surface with a polyethylene button. An anterior surgical approach is typically used, generally sacrificing the anterior cruciate ligament and sometimes the posterior cruciate ligament (PCL). With variations in prosthetic design, bearing mode, patellar resurfacing, materials, fixation method, and surgical technique, there are over 150 different knee implant designs in current use.[3]
Comparison with cemented hip prosthesis is not entirely relevant because of the structural differences between the proximal femur and the tibial plateau and the desired penetration depth at the tibial resection surface.[4] For these reasons, direct transfer of experimental results from femoral investigation to the tibial situation does not seem justifiable. Investigation and clinical application of numerous different cleaning methods and suction techniques to improve cement penetration depth at the tibia have been reported in the literature with various outcomes.[5] The present study determined optimal cleaning method in terms of cement-bone contact at the tibial resection surface.

MATERIALS & METHODS

The present study comprised of 30 tibial plateau specimens obtained during surgery for knee resurfacing arthroplasty of both genders. All patients were informed regarding the study and their written consent was obtained
Data such as name, age, gender etc. was recorded. Plateau specimens were cleaned in four different ways before cementing no cleaning (group I), manual syringe irrigation (group II), fracture brush cleaning (group III) and pulsatile jet-lavage (group IV). The specimens were cut into transverse sections and the bone cement contact distance was calculated for every 10 mm and the cement penetration depth was measured. The six cut surfaces per specimen were then scanned in an optical scanner with size reference. The scanned images were captured using the DICOM program. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 30		
Gender	**Males**	**Females**
Number	18	12

Table I shows that out of 30 patients, males were 18 and females were 12.

Table II Assessment of bone-cement contact distance

Groups	Mean (mm)	P value
Group I	13.9	0.01
Group II	19.2	
Group III	20.4	
Group IV	31.4	

Table II, graph I shows that mean bone-cement contact distance in group I was 13.9 mm, in group II was 19.2 mm, in group III was 20.4 mm and in group IV was 31.4 mm. The difference was significant (P< 0.05).

Graph I Assessment of bone-cement contact distance

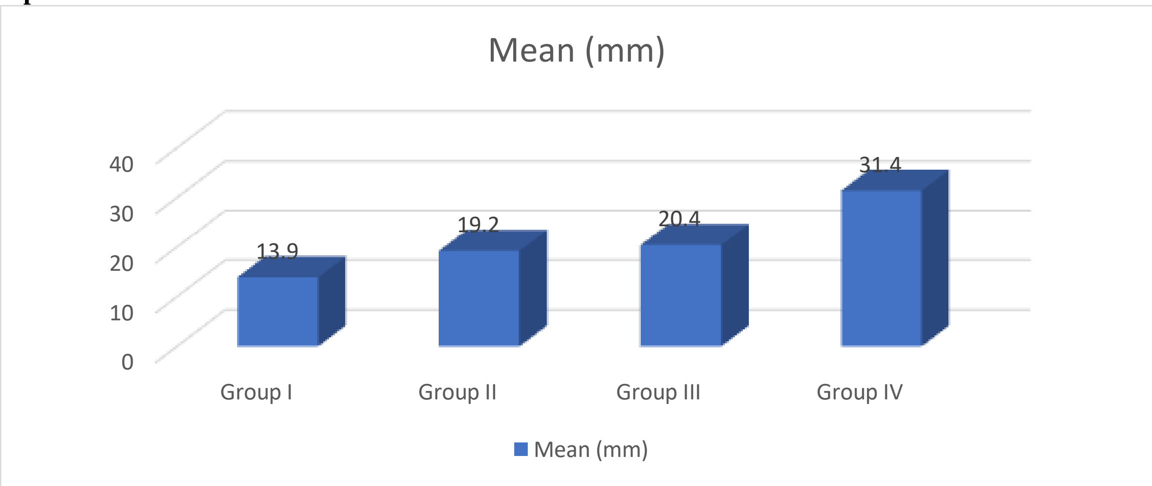
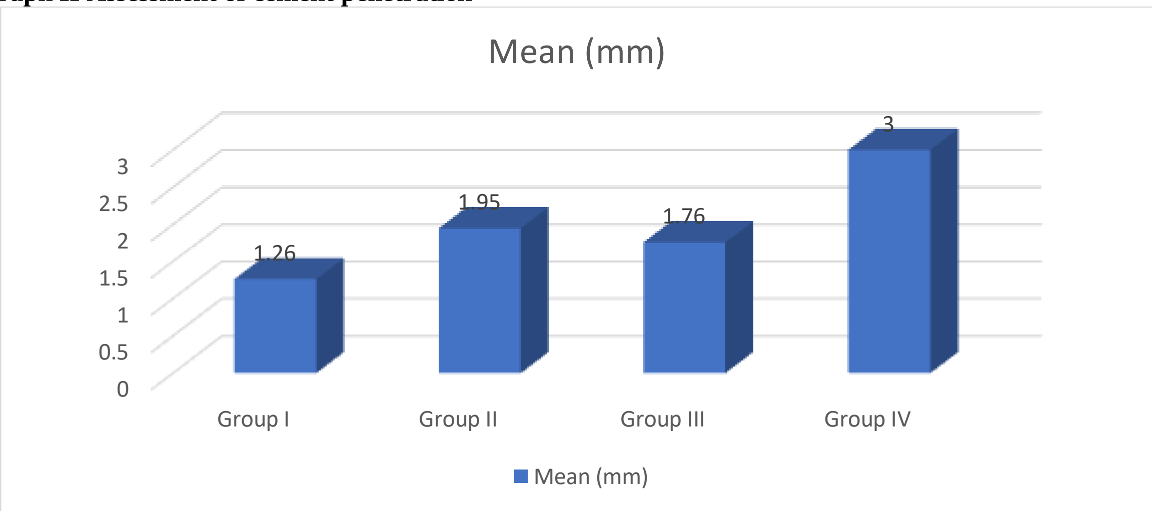


Table III Assessment of cement penetration

Groups	Mean (mm)	P value
Group I	1.26	0.01
Group II	1.95	
Group III	1.76	
Group IV	3.00	

Table III, graph II shows that mean cement penetration was 1.26 mm in group I, 1.95 mm in group II, 1.76 mm in group III and 3.00 mm in group IV. The difference was significant (P< 0.05).

Graph II Assessment of cement penetration



DISCUSSION

The knee is an articulated column whose stability depends on static stabilizers (ligaments), dynamic stabilizers (muscle-tendon units), and geometric congruity.[6] By constraining motion between components, knee prostheses may offer different levels of inherent stability to compensate for deficiencies in the native knee, including PCL-retaining, PCL-substituting, varus-valgus constrained, and rotating-hinge types.[7] The long- term stability of a knee prosthesis depends on a number of different variables. Apart from those factors that are beyond the reach of the surgeon, such as patient activity or body weight, factors that can be influenced by the surgeon need to be addressed. So far there is no evidence for the superiority of cementless fixation in the tibia.[8] Knee examination should include assessment of gait, surgical scars, localized tenderness, active and passive range of motion, limb alignment, coronal and sagittal plane ligament stability, and neurovascular status of the limb. Other pathology contributing to symptoms should be excluded by examination of the back, hip, foot, and ankle of the same limb.[9] The present study determined optimal cleaning method in terms of cement-bone contact at the tibial resection surface.

In present study, out of 30 patients, males were 18 and females were 12. Helwig et al[10] determined which tibial surface preparation technique leads to the best bone-cement contact. Human tibial plateau specimens were cleaned in four different ways before cementing: a) no cleaning, b) manual syringe irrigation, c) fracture brush cleaning, and d) pulsatile jet-lavage. The longest bone-cement contact (62 mm) was seen after PJL, the shortest (10.6 mm) after no cleaning at all. The deepest cement penetration (4.1 mm) again was seen after PJL, the least (0.7 mm) after no cleaning. Statistically, PJL yielded the longest bone-cement contact and deepest cement penetration.

We found that mean bone-cement contact distance in group I was 13.9 mm, in group II was 19.2 mm, in group III was 20.4 mm and in group IV was 31.4 mm. Ritter et al[11] were able to demonstrate the advantage of jet-lavage as early as 1994 in relation to radiolucent zones at the tibia, but it seems that a generally accepted method did not arise as a result of this evidence

We found that mean cement penetration was 1.26 mm in group I, 1.95 mm in group II, 1.76 mm in group III and 3.00 mm in group IV. Krause et al[12] investigated in an experimental study the mechanical strength of the cement-cancellous bone interlock, with respect to the bone surface preparation. They could demonstrate that the cement penetration and the cement-bone contact are valid parameters to measure the cleaning method of bone in order to fix a cemented tibial implant since the cement penetration was already used to measure this and is widely accepted.

Various clinical studies are reported to have shown that the so-called irrigation technique improves penetration depth to 3 to 5 mm. Whether this leads to further improvement in long term stability was not proven by either of these studies.[13] Deep penetration of cement may even be a disadvantage as there is a risk of thermal bone necrosis, an effect described by Huiskes and Sloof[14] for a penetration depth greater than 10 mm. The maximal penetration depth in our study was only 4.1mm and therefore not critical to a thermal effect.

CONCLUSION

Authors found better results with pulsatile jet-lavage before cementing tibial components in knee arthroplasty.

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