

Technical Note

Open Access

Improving accuracy of total knee component cementation: description of a simple technique

William B Lutes, Michael A Flierl, Michael R Dayton and Steven J Morgan*

Address: Department of Orthopaedic Surgery, Denver Health Medical Center, University of Colorado School of Medicine, 777 Bannock Street, Denver, CO 80204, USA

Email: William B Lutes - williamlutes@hotmail.com; Michael A Flierl - michael.flierl@dhha.org; Michael R Dayton - michael.dayton@dhha.org; Steven J Morgan* - steven.morgan@dhha.org

* Corresponding author

Published: 9 October 2009

Received: 3 July 2009

Journal of Orthopaedic Surgery and Research 2009, **4**:38 doi:10.1186/1749-799X-4-38

Accepted: 9 October 2009

This article is available from: <http://www.josr-online.com/content/4/1/38>

© 2009 Lutes et al; licensee BioMed Central Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Background: Total knee arthroplasty represents a common orthopedic surgical procedure. Achieving proper alignment of its components with the predrilled patellar and tibial peg holes prior to polymerization of the bone cement can be challenging.

Technique: After establishing the femoral, patellar and tibial bone cuts, the cancellous bone around the tibial keel, as well as the peg holes for the patella and femoral components are marked with methylene blue using a cotton swab stick. If bone cement is then placed onto the cut and marked bone edges, the methylene blue leaches through the bone cement and clearly outlines the tibial keel and predrilled femoral and patellar peg holes. This allows excellent visualization of the bone preparations for each component, ensuring safe and prompt positioning of TKA components while minimizing intraoperative difficulties with component alignment while the cement hardens.

Conclusion: The presented technical note helps to improve the accuracy and ease of insertion when the components of total knee arthroplasty are impacted to their final position.

Background

The prevalence of degenerative joint disease has seen a considerable increase due to general aging of the population [1-3]. Total knee arthroplasty (TKA) represents a safe and efficacious treatment option for severe arthritis of the knee [4,5]. The volume of implanted TKA is expected to increase by 40% over the next three decades [6]. Thus, the degenerated knee has been termed "the joint of the decade" [7]. A favorable outcome of TKA depends on the optimal positioning of the components and soft tissue balancing rather than the choice of implant [8,9]. Malalignment of TKA components has been associated with knee pain [10], poor patellar tracking [11], flexion gap

instability [12], loss of motion, and early implant failure [13-15]. Of note, increased prosthetic malalignment has been noted following minimally invasive total knee arthroplasty due to decreased visualization of the operative field [16,17]. Proper implant positioning and alignment during cemented TKA can be a challenging task. Malalignment of the pegs of the patella with acrylic bone cements, such as poly methylmethacrylate (PMMA), prior to cementation requires rotation of the patella, which may result in significant yet unwarranted extrusion of PMMA. Impaction of the tibial component in improper rotational alignment may create a larger space for the keel. These seemingly small errors shorten valuable working time

with the PMMA and could become catastrophic if the polymerization phase begins and the prosthesis is in improper alignment.

In the present technical note, we describe a simple modification prior to cementation of TKA components to ensure alignment of patella peg holes, tibial keel, and femoral prosthesis. This surgical technique can be performed in as little as 30 seconds. It thus marginally prolongs the surgical case while helping to avoid intraoperatively repositioning maneuvers of implant components.

Surgical technique

The standard TKA technique is pursued according to the surgeon's preference. Once the femoral, patellar and tibial bone cuts are established and the knee is balanced correctly, the cut bone surfaces are prepared for cementation in the chosen standard fashion. At this point, the cancellous bone around the tibial keel, as well as the peg holes for the patella and femoral components are marked with methylene blue using a cotton swab stick. Figure 1 depicts the cut bony surfaces following intraoperative staining of the peg holes and the tibial keel. Bone cement is then placed onto the cut bone edges and manual digital pressure is applied to the cement so the bone cuts become evident. The methylene blue leaches through the bone cement and clearly outlines the tibial keel and predrilled femoral and patellar peg holes.

The presented technique allows for excellent visualization for the appropriate placement of each component in its prepared location (Figure 2). Intraoperative delineation of the tibial keel and the predrilled pegholes thus ensures safe and prompt positioning of TKA components and avoids unwarranted intraoperative struggle with component placement while the cement hardens. As the described technique adds only about 30 seconds, minimal additional time for bone-cement preparation is required. Having the appropriate positioning marked prior to component impaction or application of the patella clamp allows for fast completion of the surgical procedure avoiding repositioning of any components.

Discussion

Total knee arthroplasty is a frequently performed surgical procedure [7]. However, it is combined with inherent risks of misalignment of implant components, which is likely to result in poor clinical and long-term outcome. In the present report, we describe a simple and straight forward technical trick that helps to insure appropriate intraoperative alignment of the TKA components. The methylene blue method assists in creating reproducibly good results during component impaction and has been successfully used in over 1000 cases at our institution. It

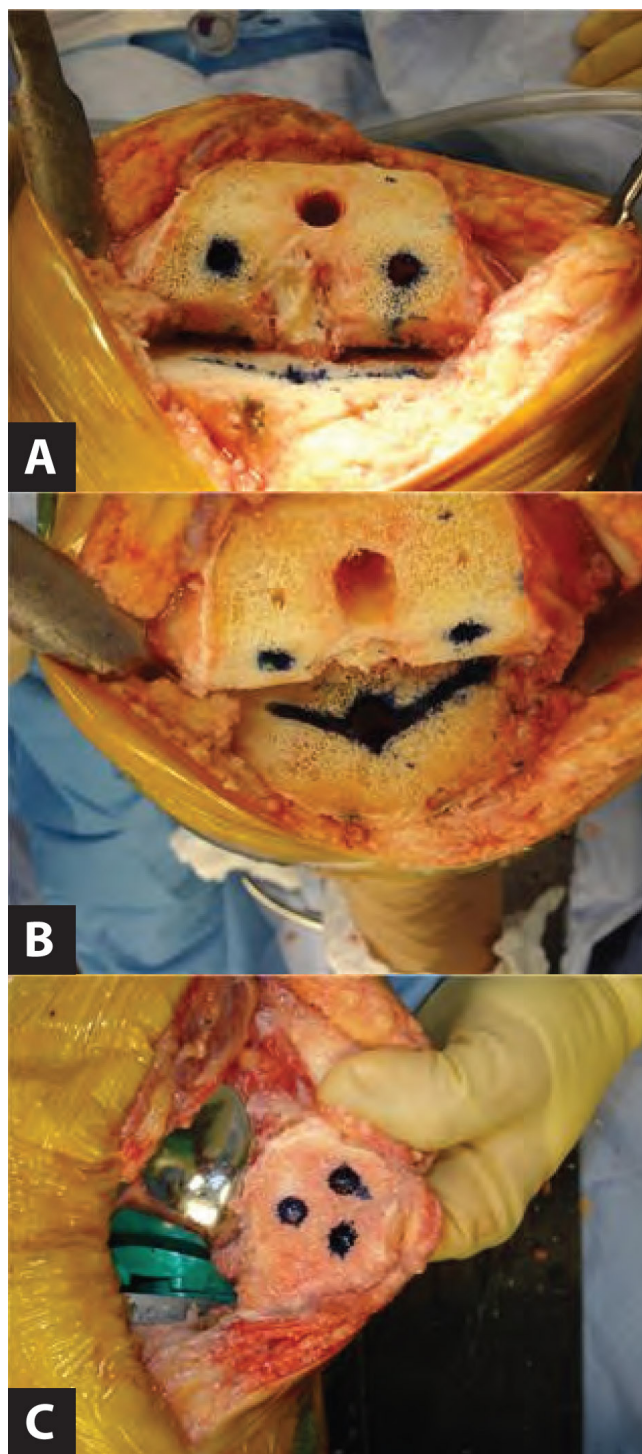


Figure 1
Intraoperative images of the femur (A), tibia (B) and patella (C) prepared with methylene blue prior to cementation.

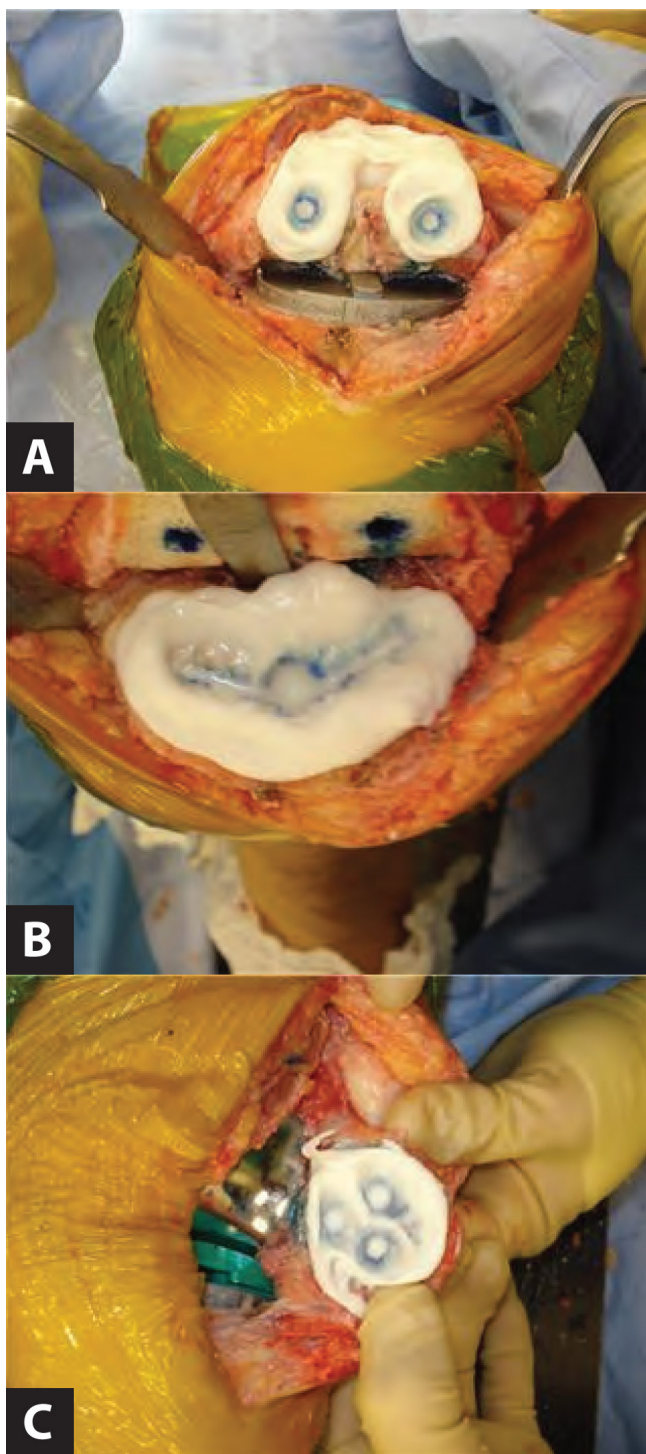


Figure 2
In situ illustration of the femur (A), tibia (B) and patella (C) with polymethylmethacrylate applied. Note the obvious leakage of the methylene blue through the bone cement, clearly outlining the tibial keel and predrilled femoral and patellar peg holes.

represents a safe and efficacious method that adds only about 30 seconds to the standard TKA procedure.

However, as the alignment of each component is highly depended on the location of predrilled peg holes, the presented technique can only allow better visualization for component implantation. As a result, rotational accuracy and alignment cannot be improved when predrilled peg holes are rotationally malaligned. In addition, surgeons routinely applying the cement to the prosthesis prior to component placement will not benefit from the described technical trick.

This small change in technique prior and during cementation may prevent intraoperative complications and struggles with optimizing the implant alignment during the 6-10 minute time-window until the PMMA cures [18], and thereby help avoid unwarranted intraoperative complications and maximize patient safety. We hope that our practical note may facilitate and assist other surgeons performing TKAs on a routine basis.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

WBL, MRD and SJM designed the manuscript. MAF and SJM wrote the manuscript. All authors approved the final version of this review.

Acknowledgements

The described surgical trick has been taught by Lawrence Dorr, M.D., for many years.

References

1. Badley EM, Wang PP: **Arthritis and the aging population: projections of arthritis prevalence in Canada 1991 to 2031.** *J Rheumatol* 1998, **25**(1):138-144.
2. Gignac MA, Davis AM, Hawker G, Wright JG, Mahomed N, Fortin PR, Badley EM: **"What do you expect? You're just getting older": A comparison of perceived osteoarthritis-related and aging-related health experiences in middle- and older-age adults.** *Arthritis Rheum* 2006, **55**(6):905-912.
3. Perruccio AV, Power JD, Badley EM: **Revisiting arthritis prevalence projections--it's more than just the aging of the population.** *J Rheumatol* 2006, **33**(9):1856-1862.
4. Callahan CM, Drake BG, Heck DA, Dittus RS: **Patient outcomes following tricompartmental total knee replacement. A meta-analysis.** *JAMA* 1994, **271**(17):1349-1357.
5. Robertsson O, Knutson K, Lewold S, Lidgren L: **The Swedish Knee Arthroplasty Register 1975-1997: an update with special emphasis on 41,223 knees operated on in 1988-1997.** *Acta Orthop Scand* 2001, **72**(5):503-513.
6. Birrell F, Johnell O, Silman A: **Projecting the need for hip replacement over the next three decades: influence of changing demography and threshold for surgery.** *Ann Rheum Dis* 1999, **58**(9):569-572.
7. Moran CG, Horton TC: **Total knee replacement: the joint of the decade. A successful operation, for which there's a large unmet need.** *BMJ* 2000, **320**(7238):820.
8. Moreland JR: **Mechanisms of failure in total knee arthroplasty.** *Clin Orthop Relat Res* 1988, **226**:49-64.
9. Lotke PA, Ecker ML: **Influence of positioning of prosthesis in total knee replacement.** *J Bone Joint Surg Am* 1977, **59**(1):77-79.

10. Barrack RL, Schrader T, Bertot AJ, Wolfe MW, Myers L: **Component rotation and anterior knee pain after total knee arthroplasty.** *Clin Orthop Relat Res* 2001, **392**:46-55.
11. Matsuda S, Miura H, Nagamine R, Urabe K, Hirata G, Iwamoto Y: **Effect of femoral and tibial component position on patellar tracking following total knee arthroplasty: 10-year follow-up of Miller-Galante I knees.** *Am J Knee Surg* 2001, **14(3)**:152-156.
12. Scuderi GR, Komistek RD, Dennis DA, Insall JN: **The impact of femoral component rotational alignment on condylar lift-off.** *Clin Orthop Relat Res* 2003, **410**:148-154.
13. D'Lima DD, Chen PC, Colwell CW Jr: **Polyethylene contact stresses, articular congruity, and knee alignment.** *Clin Orthop Relat Res* 2001, **392**:232-238.
14. Ritter MA, Faris PM, Keating EM, Meding JB: **Postoperative alignment of total knee replacement. Its effect on survival.** *Clin Orthop Relat Res* 1994, **299**:153-156.
15. Berend ME, Ritter MA, Meding JB, Faris PM, Keating EM, Redelman R, Faris GW, Davis KE: **Tibial component failure mechanisms in total knee arthroplasty.** *Clin Orthop Relat Res* 2004, **428**:26-34.
16. Chen AF, Alan RK, Redziniak DE, Tria AJ Jr: **Quadriceps sparing total knee replacement. The initial experience with results at two to four years.** *J Bone Joint Surg Br* 2006, **88(11)**:1448-1453.
17. Dalury DF, Dennis DA: **Mini-incision total knee arthroplasty can increase risk of component malalignment.** *Clin Orthop Relat Res* 2005, **440**:77-81.
18. Kuehn KD, Ege W, Gopp U: **Acrylic bone cements: composition and properties.** *Orthop Clin North Am* 2005, **36(1)**:17-28.

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp

