Arthroplasty Today xxx (2018) 1–6

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Surgical technique

Acetabular wedge augments for uncontained tibial plateau defects in revision total knee arthroplasty

Jeffrey B. Stambough, MD [a, *], Jacob A. Haynes, MD [b], Robert L. Barrack, MD [b], Ryan M. Nunley, MD [b]

[a] Department of Orthopaedic Surgery, University of Arkansas for Medical Sciences, Little Rock, AR, USA
[b] Department of Orthopaedic Surgery, Washington University School of Medicine, St. Louis, MO, USA

ARTICLE INFO

Article history:
Received 19 November 2017
Received in revised form
2 February 2018
Accepted 9 February 2018
Available online xxx

Keywords:
Revision total knee arthroplasty
Acetabular augment
Tibial bone loss
Uncontained defect

ABSTRACT

Tibial bone loss is a common scenario encountered during revision total knee arthroplasty. Reconstructive options depend on the amount and location of bone loss, but few good solutions exist to address large, uncontained tibial defects where cortical support is lost in the metadiaphyseal region. We describe a novel technique using acetabular augments to buttress a revision tibial component and recreate a hemiplateau during tibial revision total knee arthroplasty. In selected scenarios, this construct can create a biomechanically friendlier surface onto which to support the tibial tray and a less expensive option when compared to traditional stacked augments or cones.

Level of Evidence: IV—Case series.

Introduction

Surgeons have multiple options when considering management of damaged or deficient tibial metaphyseal bone loss in the setting of a revision total knee arthroplasty (TKA). Surgical decisions are dependent on the primary mode of tibial failure and remaining amount of host bone. These solutions can range from bone stock restoration to bone replacing techniques. Restoration options primarily refer to using femoral head impaction grafting to regain structural support [1,2], while replacement options abound: stemmed components with hybrid fixation [3], modular augments, porous metal metaphyseal-replacing sleeves [4] or cones [5,6], or use of a megaprosthesis [7]. The applicability of each option depends on the surgeon preference and comfort using varying constructs, the cost of revision implant materials, and the primary mode of tibial failure, which is often determined intraoperatively after implant removal and assessment of remaining host bone.

The Anderson Orthopaedic Research Institute (AORI) classification of bony defects is the gold-standard measure used to classify such bony defects [8]. However, sometimes the utility of a type II (damaged metaphysis) or type III (deficient metaphysis) diagnosis is not always applicable because it cannot distinguish between contained and uncontained defects [9,10]. Specifically, when addressing uncontained tibial-sided bone loss, surgeons tend to gravitate toward using augments with or without cement and additional bone grafting [11]. However, these augments have limitations when used in cases of presumed type II bone loss. There are reports of failure when used alone or when the uncontained metaphyseal defects is larger than 40% of the tibial surface and involves more than 25% of the peripheral cortical rim [12,13]. Furthermore, the 3-dimensional shape of an uncontained bony defect usually does not allow for the use of 1 implant, resulting in the use of multiple fixation constructs, such as stacks of augments or cones with additional screws, thus increasing the overall surgical cost of the revision episode of care.

The purpose of this study is to describe a novel surgical application using a highly porous acetabular wedge augments to reconstitute metadiaphyseal support for a stemmed prosthesis in revision TKA. Secondarily, we report on the survivorship and outcomes of this construct in a series of patients with uncontained

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to https://doi.org/10.1016/j.artd.2018.02.005.

* Corresponding author. 4301 West Markham Street, Slot 531, Little Rock, AR 72205, USA. Tel.: +1 513 479 9826.
E-mail address: jeffrey.stambough@gmail.com

https://doi.org/10.1016/j.artd.2018.02.005

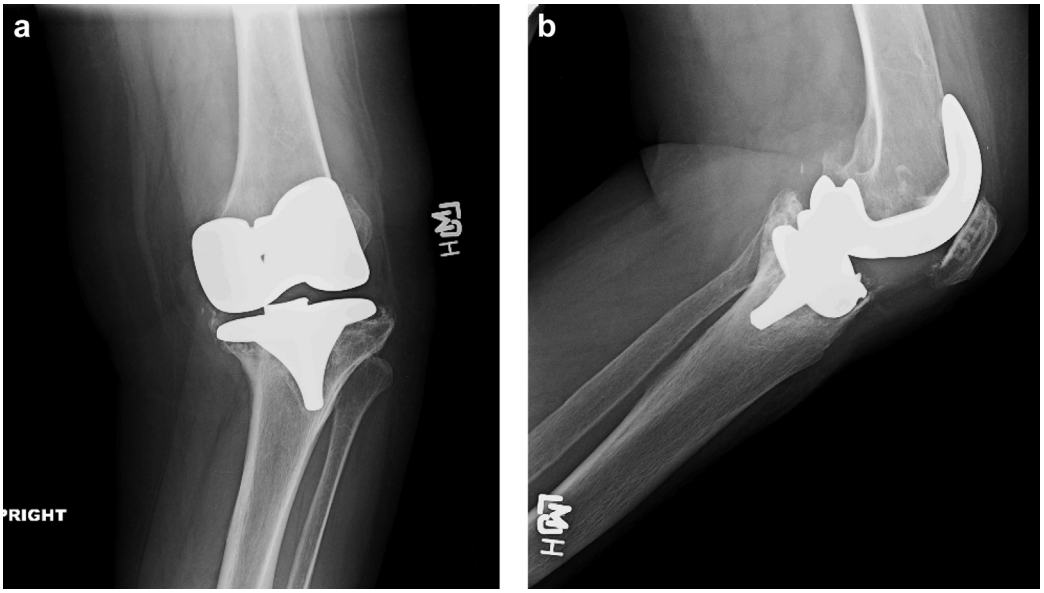

Figure 1. Representative anteroposterior (AP) (a) and lateral (b) knee radiograph demonstrating significant varus collapse of primary tibial base tray with significant metaphyseal bone loss.

metaphyseal bone loss involving 40%-70% of the supporting medial tibial plateau cortical rim. Finally, we will propose a modification to the AORI classification for tibial bone defects to include contained and uncontained defects to better drive surgical decision-making.

Surgical technique

Patients are first evaluated in the clinic and indicated for revision knee arthroplasty. All patients get biplanar EOS(R) standing hip-knee-ankle radiographs (EOS Imaging, Paris, France). Complete infection workup, including serum erythrocyte sedimentation rate and noncardiac C-reactive protein, is obtained, with joint aspiration pursued if either of the serum markers are elevated. Indications for considering a hemiwedge acetabular augment are for isolated medial tibial defects with significant bone loss extending into the metadiaphyseal region with an estimated <50% of supportive cortical rim remaining to achieve fit with a standard wedge or trabecular metal cone. At the time of surgery, prior components are explanted using a microsagittal saw, flexible osteotomes, and other disimpaction tools, as conversion to a more constrained prosthesis is usually indicated. Thorough synovectomy and medial release should be performed as well in an attempt to preserve the superficial medial collateral ligament sleeve, as this can influence one's ability to choose a posterior-stabilized vs a constrained or hinge construct.

Once all components are removed, meticulous attention needs to be used to remove all cement (if present) from the tibial cut surface and the canal. The use of a small round burr, osteotomes and gouges from a knee revision system can expedite the process. At this time, a freshening cut of the tibial surface should be performed at a 90° angle to the mechanical axis of the tibia. All fibrous tissue should be aggressively removed to determine the final amount of bone defect for staging and decision-making. The medial tibial plateau defect should be closely examined, noting the amount and quality of intact cortical rim, depth of bone loss, and overall surface area remaining of cut tibial surface to help size and position the revision tibial tray position. A stemmed tibial trial with or without a sleeve can then be placed after sequential reaming of the tibial canal to confirm tray sizing and rotation. If the amount of overall depth of medial structural bone loss is so significant, trialing components, even with a sleeve and proximal block augments, will show medial collapse as the tibia sleeve-stem construct rotates the sleeve tilts because of the lack of medial bone support.

An acetabular augment trial should then be placed by trial-and-error sizing, starting with the thinnest, smallest diameter wedge to assess buttress fit with the convex surface resting on the remaining diaphyseal medial cortex. Sizing should be based on achieving a flat tibial surface so that the lateral cortical height is the same as the augment, while also insuring the anteromedial overhang of the convex component is not too excessive to prevent closure of the medial tissue sleeve. Commonly, the convex portion of the acetabular augment does not have perfect contact to the remaining metadiaphyseal bone and the use of a high-speed burr is required to shape the bone to maximize contact surface area and augment fit. When cementing final implants, we recommend placing the stemmed component first and press-fitting the acetabular augment secondly into the previously prepared bony bed. Finally, cement should be used to fill in gaps and adjoin the constructs.

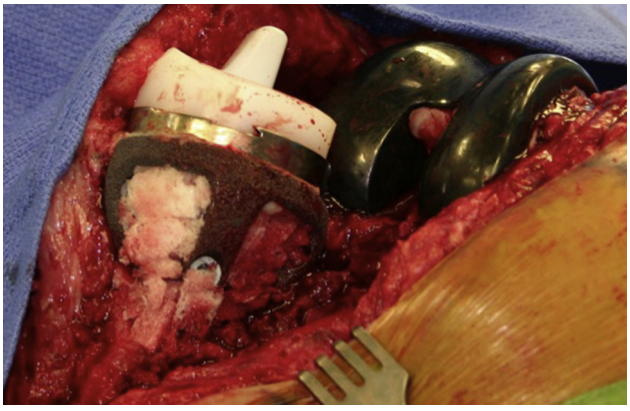

Figure 2. Intraoperative image demonstrating placement of acetabular augment and securing in a buttress fashion with placement of screws from medial to lateral with final packing of bone graft around the augment. Alternatively, this can be cemented into place and remaining slots can be filled with bone graft substitute before final closure.