Surgical technique

Medial tibial “spackling” to lessen chronic medial tibial soft tissue irritation

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A B S T R A C T

We describe a unique, utilitarian reconstructive treatment option known as tibial “spackling” for chronic, localized medial joint line pain corresponding with progressive radiographic peripheral medial tibial bone loss beneath a well-fixed revision total knee arthroplasty tibial baseplate. It is believed that this localized pain is due to chronic irritation of the medial capsule and collateral ligament from the prominent medial edge of the tibial component. In the setting of failed nonoperative treatment, our experience with utilizing bone cement to reconstruct the medial tibial bone defect and create a smooth medial tibial surface has been successful in eliminating chronic medial soft tissue irritation.

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Introduction

Approximately 20%-30% of total knee arthroplasty (TKA) patients are not satisfied with their clinical outcomes [1,2]. Patient dissatisfaction is multifactorial and associated with several complications or adverse events that can result in inferior outcomes [3-6]. Common complications known to worsen outcomes include infection, instability, and fracture [7,8]. There have been several studies that have evaluated femoral and tibial bone loss in revision TKA [9,10]. We are unaware of any study specifically reporting the need for revision TKA occurring from peripheral postoperative medial tibial bone loss and subsequent pain resulting from the relatively sharp edge of an exposed tibial tray. While the etiology of medial tibial bone loss after revision TKA is uncertain and may be multifactorial, causes may include osteolysis without component loosening, stress shielding, or vascular compromise. We describe the technique and provide a case example of a patient that developed symptoms from progressive postoperative medial tibial bone loss after revision TKA and underwent a unique surgical treatment method referred to as medial tibial “spackling” to eliminate the chronic medial tibial pain.

Surgical technique

Before undergoing tibial spackling, it is imperative to rule out other, more common, causes of pain, such as infection, loosening, or instability. In addition, the patient should have completed a thorough course of nonoperative management, which may include treatment with nonsteroidal anti-inflammatory medications, physical therapy and targeted phonophoresis, and even localized injections. If these modalities fail, medial tibial spackling may be considered. A standard, midline approach utilizing the patient’s prior incision should be performed along with a medial parapatellar arthrotomy. We routinely perform a synovectomy to remove any intra-articular scar or inflammatory synovium. This not only helps with exposure but also permits thorough inspection of the components including the bearing to confirm that there is no other possible source of pain. A medial subperiosteal release to the posteromedial corner of the knee is then performed to expose the medial border of the tibial tray. Operative findings should correspond with preoperative imaging, showing prominence and overhang of the tray from medial bony resorption (Fig. 1). Before
spackling, it is necessary to prepare the proximal medial tibia. The area of resorption beneath the tray is often filled with fibrous tissue, and this should be curetted down to bone. A small drill bit is then used to drill holes into the bone roughly 3-4 mm deep to enhance cement pressurization and fixation (Fig. 2). We routinely inflate a pneumatic tourniquet on the thigh to provide a dry bone bed for cement application after the bone has been irrigated (Fig. 3). A one-half batch of cement is then mixed. The bone cement is then taken and pressurized manually into the medial tibial bone drill holes initially. An elevator or freer is then used to “spackle” additional cement into the bone void (Fig. 4). Care is taken in applying the bone cement evenly and shaping it within the void to create a smooth border along the proximal medial tibia, eliminating tray overhang and allowing the medial collateral ligament to traverse over without irritation. As the cement hardens, it is manually contoured to replicate the native proximal tibial contour (Figs. 5 and 6). After the cement cures, firm pressure is applied to ensure that it is stable. Closure then proceeds in the standard fashion.

Case example

A 71-year-old woman presented to our clinic for evaluation of a painful left TKA performed at an outside facility 16 years prior. Surgical history before the TKA included a Maquet tibial tubercle osteotomy and a high tibial osteotomy. Her postoperative TKA course was uncomplicated, and her TKA functioned very well until 1 year before her presentation to our institution. She noted progressive instability and substantial debility when attempting to descend stairs.

Clinical examination demonstrated a slight antalgic gait. Range of motion was from 3 degrees of hyperextension to 105 degrees of flexion. Substantial coronal and sagittal plane instability with a 2+ effusion were observed. Infection was ruled out with normal serum erythrocyte sedimentation rate and C-reactive protein, and joint aspirate yielding nucleated white blood cell count of only 325 cells/µL. Radiographs revealed a cruciate-retaining TKA with an uncemented tibial implant with incomplete radiolucent lines. Her femoral and patellar components appeared to be well fixed (Fig. 7).

The patient was subsequently revised utilizing a rotating platform, constrained condylar design (PFC Sigma Rotating Platform Total Condylar 3; DePuy, Inc., Warsaw, IN; Fig. 8). Her immediate postoperative course was unremarkable. She functioned very well with no substantial pain, swelling, or functional limitation until 2 years after the revision procedure. At that time, she began having increasing medial-sided knee pain and progressive swelling. She was noted to have substantial anteromedial tibial pain, particularly when palpating along the medial joint line. A significant effusion
was noted. Her knee was subsequently aspirated twice with negative cultures. Evaluation of sequential postoperative radiographs taken over the first 2 postoperative years revealed progressive peripheral medial tibial bone loss under the medialmost aspect of the tibial component resulting in a medial prominence of the tray beyond the remaining medial tibial bone (Figs. 9 and 10). A technetium bone scan did not reveal a source for her pain or bone resorption. The patient was treated with a comprehensive nonoperative regimen including activity modification, multiple nonsteroidal anti-inflammatory drugs, and physical therapy.

Figure 5. Intraoperative photo showing cured cement shaped to normal contour of the proximal medial tibia.

Figure 6. Additional intraoperative photo showing cured cement after spackling which fills the void from the medial tibial bone resorption with no subsequent prominence of the revision tibial tray.

Figure 7. Anteroposterior (AP) radiograph of the left knee before revision TKA on initial presentation.

Figure 8. Six-week postoperative AP radiograph of the left knee after revision TKA.
including phonophoresis and icing but remained symptomatic. A “diagnostic” injection containing a corticosteroid and local anesthetic was administered into the anteromedial soft tissue where the patient was most tender. This provided her with excellent short-term pain relief. It was believed that the most likely source for her pain was related to the prominent edge of the medial aspect of the tibial component irritating the adjacent medial soft tissues (capsule and collateral ligament).

After thorough discussion of treatment options, the patient elected to proceed with the tibial spackling procedure as described previously in lieu of continued nonoperative management. The experimental nature of the procedure and the uncertainty of the result were thoroughly reviewed with the patient preoperatively. The patient was discharged from the hospital on postoperative day 1 utilizing 2 crutches for ambulation with no weight-bearing restrictions. Ambulatory aids were discontinued at 2 weeks. One year after the tibial spackling procedure, she reported that her medial knee pain and swelling had completely resolved which was quantified by an improvement of her Knee Society Score which increased from a preoperative value of 93-170 points 1 year postoperatively. Her radiographs showed no further bone resorption, and the cement mantle remained stable with no evidence of debonding or loosening (Fig. 11).

Discussion

The preceding case report describes a patient who developed substantial medial-sided knee pain after undergoing revision TKA for global instability. On evaluating serial radiographs and performing an extensive workup, the medial knee pain was attributed to gradual medial tibial bone resorption and subsequent

Figure 9. One-year postoperative AP radiograph of the left knee demonstrating medial tibial bone loss.

Figure 10. Two-year postoperative AP radiograph of the left knee demonstrating progressive medial tibial bone loss.

Figure 11. Recent follow-up AP radiograph of the left knee 2.5 years after medial tibial “spackling.”
soft tissue irritation secondary to a prominent tibial tray. The patient was treated with a revision surgical procedure which reconstructed the medial tibial bone loss with bone cement (“spackling”) to create a smooth medial tibial surface against which the medial tibial soft tissues traverse. Two and a half years after the operative intervention, the patient was noted to be asymptomatic with no radiographic evidence of further medial tibial bone loss or cement loosening.

The etiology of the medial tibial bone loss in this patient is uncertain. The patient was initially implanted with a thinner, uncemented titanium tibial baseplate and revised with a thicker (5 mm) cobalt–chromium tibial component with a longer central tibial stem. It is possible that most of the bone resorption in this patient was the result of stress shielding imparted by the more rigid cobalt–chromium tray. Some resorption may have resulted from some vascular compromise of the medial tibia from the medial soft tissue releases performed at the time of the initial revision TKA or from the previous osteotomy procedures performed involving the proximal tibia. These are proposed mechanisms, and other causes of medial tibial bone resorption are possible.

It is important to note the extensive preoperative workup this patient underwent before proceeding with a medial tibial “spackling” procedure. The patient presented with a late onset of recurrent effusions and was able to pinpoint the area of irritation to the prominent medial tibial trabecula. In addition, multiple evaluations to rule out infection were performed preoperatively. The patient was then referred for a second opinion to identify the source of her medially based knee discomfort. However, the second opinion surgeon was unable to identify an additional source. Finally, the patient underwent a diagnostic injection, specifically targeting the soft tissues around the prominent medial tibial baseplate. After identifying that the injection provided the patient with temporary relief of pain and that other sources of medial tibial pain had been ruled out, the patient underwent the medial spackling procedure. Initially, the type of material used to reconstruct the medial tibial bone defect was debated. It was believed that if bone graft or bone graft substitute was used, it may eventually be resorbed and would be difficult to contain within the bone defect. While future loosening of the bone cement is a concern, technical steps to minimize this risk were undertaken, including using drill holes within the bed of the defect and pressurizing the holes with cement to enhance fixation. In addition, we feel that it is absolutely necessary to have a dry, clean bony surface devoid of any fibrous tissue that is often found within these lesions when the cement is applied. While one may argue that augmenting the reconstruction with a screw could be beneficial, the cases observed and treated by the authors with this technique have shown lesions that are relatively noncavitary and thus not necessarily appropriate for a cement and screw technique.

While this discussion represents a unique case report of progressive medial tibial bone loss and its treatment in the revision setting, there are several limitations. The ability to accurately diagnose the cause of this patient’s symptoms was challenging. An attempt was made to rule out other causes of postoperative knee pain including infection, implant loosening, and so forth. A “diagnostic” injection was performed into the medial soft tissues to determine if the patient had any relief of symptoms. We acknowledge that the diagnostic accuracy of these measures to identify medial collateral ligament irritation secondary to a prominent tibial tray is unknown. It is possible that this patient’s symptoms were not related to the medial bone loss and may have resolved over time without any intervention. Finally, this patient has been followed for only 2.5 years postoperatively and therefore will need to be followed for a longer period of time to determine if she will develop further medial tibial bone loss, a return of symptoms, or develop loosening of the implanted medial tibial cement. We have subsequently performed a medial tibial “spackling” procedure on 3 additional patients with the same problem and have observed similar results but with shorter follow-up duration.

Summary

The technique and clinical case example presented describe a unique instance in which a patient underwent reoperation after revision TKA for progressive medial tibial bone loss and medial knee pain. Bone cement was used to reconstruct the deficient medial tibial bone to provide a smooth medial tibial surface for the medial soft tissues to articulate against a procedure we have described as “spackling”. This procedure totally resolved the patient’s pain. The cause for the medial tibial bone resorption is unknown but may be the result of stress shielding from a thicker, cobalt–chromium tibial component or secondary to osseous vascular compromise resulting from multiple previous surgical knee procedures. We recommend a number of months of nonoperative treatment and a thorough elimination of other causes of chronic medial knee pain before considering this procedure.

References