ABSTRACT

Purpose. To evaluate the outcome of autologous morselised bone grafting for a medial tibial defect of ≥10 mm deep in 45 total knee arthroplasties (TKAs).

Methods. 38 patients aged 46 to 85 (mean, 73) years underwent 45 TKAs and autologous morselised bone grafting for a medial tibial defect of ≥10 (range, 10–25) mm in depth by a single surgeon. In the first 19 TKAs, 2 resected subchondral bone plates from the lateral tibial plateau were driven into 2 gutters made on the floor of the medial tibial defect as bony support posts. Morselised cancellous bone grafts were then impacted around these posts. In the remaining 26 TKAs, multiple drill holes were made on the floor of the medial tibial defect as bony support posts. Morselised cancellous bone grafts were then impacted around these posts. In the remaining 26 TKAs, multiple drill holes were made on the floor of the defect to decrease the remodelling time. Morselised cancellous bone grafts were impacted to fill the defects. The tibial components were fixed with cemented (n=34) or non-cemented (n=11) technique. Internal fixation devices were not used; stem extension was used in only 2 TKAs (in a patient with Charcot joint and a patient undergoing revision TKA).

Results. After a mean follow-up duration of 65 (range, 24–174) months, no patient showed gait disturbance. The mean knee flexion angle was 113.8º (range, 90º–130º). No absorption or collapse of the grafted bone, or component loosening were noted on radiographs. The grafted bone completely incorporated into the host bone, with bony trabeculae crossing the interface within 2 years in the first 19 TKAs and within one year in the latter 26 TKAs. The margin of the grafted area resembled bony cortex in 30 TKAs.

Conclusion. Autologous morselised bone grafting is a viable option for most medial tibial defects during TKA.

Key words: arthroplasty, replacement, knee; bone transplantation

INTRODUCTION

During total knee arthroplasty (TKA), medial tibial defects can be filled with bone cement,1,2 metal
augmentation, or allogeneous or autologous bone grafts. A defect depth of <5 mm should be filled with bone cement; a defect depth of 5 to 10 mm should be filled with bone grafts; and a defect depth of >10 mm should be filled with a metal wedge or other metal augmentation. For TKA, it is important to preserve as much bone as possible for future revision surgeries. This study evaluated the outcome of autologous morselised bone grafting for a medial tibial defect of ≥10 mm deep in 45 TKAs.

MATERIALS AND METHODS

Between November 1997 and September 2011, 38 patients aged 46 to 85 (mean, 73) years underwent 45 TKAs and autologous morselised bone grafting for a medial tibial defect of ≥10 (range, 10–25) mm in depth by a single surgeon. The diagnoses for the 45 TKAs included osteoarthritis (n=29), rheumatoid arthritis (n=8), osteonecrosis of the medial tibial plateau (n=6), Charcot joint (n=1), and revision of a unicompartmental knee arthroplasty (n=1).

The types of TKA implants used were NexGen (Zimmer, Warsaw [IN], USA) [n=17], Genesis II (Smith & Nephew, Memphis [TN], USA) [n=8], Magna-ROM 21 (Centerpulse, Austin [TX], USA) [n=7], LCS (Depuy, Warsaw [IN], USA) [n=6], Kinemax Plus (Stryker Howmedica, Rutherford [NJ], USA) [n=5], and Profix (Smith & Nephew, Memphis [TN], USA) [n=2].

According to the Dorr classification, the defect was classified as central (n=1) or peripheral (n=44).

According to the Watanabe classification, the defect was classified as flat peripheral (n=14) or slant peripheral (n=30) [Fig. 1]. After horizontal osteotomy of the tibial articular surface, the mean mediolateral width and depth of the medial tibial defects were 18.0 (range, 10–25) mm and 13.0 (range, 10–23) mm, respectively.

In the first 19 TKAs, 2 resected subchondral bone plates are then driven into the gutters as bony support posts (asterisks). Morselised cancellous bone grafts are impacted around the posts using an assistant’s index finger as a bank. The defect is filled with 2 bony posts and the impacted cancellous bone (asterisk).
plates from the lateral tibial plateau were driven into 2 gutters made on the floor of the medial tibial defect as bony support posts. Morselised cancellous bone grafts were then impacted around these posts (Fig. 2). Remodelling of the bone grafts was evaluated using 3-phase bone scintigraphy after 2 years. In the remaining 26 TKAs, multiple drill holes were made on the floor of the defect to decrease the remodelling time. Morselised cancellous bone grafts were impacted to fill the defects (Fig. 3). To prevent bone cement from entering the space between the graft and the tibial host bed, morselised cancellous bone grafts were firmly impacted using a metal bar and manual pressure.

The tibial components were fixed with cemented (n=34) or non-cemented (n=11) technique. Internal fixation devices were not used; stem extension was used in only 2 TKAs (in a patient with Charcot joint and a patient undergoing revision TKA).

RESULTS

After a mean follow-up duration of 65 (range, 24–174)
months, no patient showed gait disturbance. The mean knee flexion angle was 113.8° (range, 90°–130°). No absorption or collapse of the grafted bone, or component loosening were noted on radiographs. Generally, the grafted bone showed osteosclerotic changes at around 2 to 3 months. Then, the osteosclerosis became less dense and bony trabeculae could be seen. Finally, the grafted bone completely incorporated into the host bone, with bony trabeculae crossing the interface within 2 years in the first 19 TKAs and within one year in the latter 26 TKAs (Fig. 4). The margin of the grafted area resembled bony cortex in 30 TKAs (Fig. 5a). In the patient with Charcot joint, bone union occurred, but there were small deficits in the grafted area (Fig. 5b).

DISCUSSION

Autologous morselised bone grafting for large medial tibial defects can preserve bone for future revision surgeries. Although bone cement should be used to fill a small defect, with a depth of ≤2 mm, autologous morselised bone grafts can be used in any defect depth of ≥3 mm (including slant peripheral defects), without additional bone cuts to convert the peripheral defect into a single oblique cut.14 Bone cement has achieved good outcome after a mean of 7.1 years1 and 6.1 years.2 Metal augmentation also achieves good outcome, but the incidence of radiolucent lines at the bone-metal interface varies from 11% to 54%.3,5 Thus, when metal augmentation is used, the bone-implant interface may result in a complicated shape that limits its stability. Stem extension to decrease the load at the bone-implant interface is necessary when metal augmentation is used. When bone cement or metal augmentation is used, whether the bone stock is adequate for future revision surgeries is a major concern. Both allogeneic and autogenous bone grafting can preserve the bone stock and achieve good outcomes. Allografts have achieved good outcomes for patients with severe bone deficiency in revision TKA6 and primary TKA.7 Nonetheless, a stemmed component is recommended to reduce the stress on the allograft, host bone, and the fixation interface.7 For autografts, the overall 5-year success rate was reported to be only 67% when used with Kirschner wires or screws.9 However, other studies have reported good outcomes.8,10–12

Augmentation of bone defects is indicated during TKA when ≥40% of the bone-implant interface is unsupported by host bone.17 Autologous morselised bone grafting can be performed without any internal fixation devices, but metal augmentation and allogeneic bone grafting usually require a stem extension. It is difficult to obtain autologous block bone from resected femur or tibia when a medial tibial defect is ≥10 mm deep. Our technique can be used for medial tibial defects of ≥10 mm deep. The incorporation rate of the grafted bone has been reported to be 82 to 100%,8,10,11 In our study, incorporation was completed within 2 years in the first 19 TKAs and within one year in the remaining 26 TKAs. However, for defects of >20 mm deep, autologous bone grafting with 2 bony support posts should be used.

One limitation of this study was that clinical evaluation was limited. The number of patients was small and the follow-up period was relatively short.

CONCLUSION

Autologous morselised bone grafting is a viable option for most medial tibial defects during TKA.

DISCLOSURE

No conflicts of interest were declared by the authors.
REFERENCES