Mid-term clinical outcomes of modular unlinked bicompartmental knee arthroplasty (BiKA) for medial and patellofemoral osteoarthritis of the knee

Rikiya Baba[1,2,4], Tatsunori Maeda[1], Akane Iwadate[1], Koji Iwasaki[2], Tomohiro Onodera[2], Eiji Kondo[3], Norimasa Iwasaki[2], Yasumitsu Ohkoshi[1]
[1]Dept. of Orthopaedic Surgery, Hakodate Orthopedic Clinic, Hakodate, Japan, [2]Dept. of Orthopaedic Surgery, Faculty of Medicine and Graduate School of Medicine, Hokkaido University, Sapporo, Japan, [3]Centre for Sports Medicine, Hokkaido University Hospital, Sapporo, Japan, [4] Dept. of Orthopaedic Surgery, Iwamizawa Municipal General Hospital, Iwamizawa, Japan, Email of Presenting Author; baba76767688@gmail.com
Disclosures: R. Baba (N), Y. Ohkoshi (N), T. Maeda (N), A. Iwadate (N), K. Iwasaki (N), T. Onodera (N), E. Kondo (N), N. Iwasaki (N)

INTRODUCTION: Modular unlinked bicompartmental knee arthroplasty (BiKA), which combines medial unicompartmental knee arthroplasty (UKA) with patellofemoral arthroplasty (PFA), is expected to yield satisfactory outcomes for patients who suffer from bicompartmental knee osteoarthritis. However, the mid-term results are still unclear and controversial due to the insufficient number of surgery cases. The authors have performed a number of BiKA since it was first developed. Currently, we have evaluated the five-to-nine year results of modular unlinked BiKA. The purpose of this study is to report the mid-term results of BiKA.
METHODS: A retrospective observational study was conducted at Hakodate Orthopaedic Clinic with data from patients who had undergone modular unlinked BiKA (Figure 1). This study was approved by the research ethics committee of our clinic, and informed consent was obtained from each subject before commencement. Seventy-four knees (71 patients, age 68.9 ± 7.8 years) who underwent modular unlinked BiKA at our hospital between 2011 and 2017 with a follow-up of 5 to 9 years were enrolled. Short to mid-term results were assessed by evaluating knee range of motion (ROM), the 2011 Knee Society Score (2011KSS), Japanese Knee Osteoarthritis Measure (JKOM) and radiological findings. Moreover, to reveal the impact of PF overstuffing after BiKA on clinical outcomes, the degree of postoperative PF overstuffing was evaluated by computed tomography (CT) and magnetic resonance images (MRI) for 55 knees. Overstuffing was considered to occur if the value of PF height increased after surgery. The PF height was defined as the combined value of both patellar thickness and anterior femoral height. The difference between pre and post-operative PF height was designated as total overstuffing (TOS). To assess the impact of postoperative PF overstuffing on clinical outcome, we investigated the correlations between the overstuffing value and the postoperative clinical outcomes.
RESULTS: Mean knee ROM improved significantly from 132.3° pre-operatively to 135.5° at the final follow-up ($p = 0.038$). They also had a high mean value of postoperative 2011KSS (124.1 ± 20.7). Mean total JKOM score improved significantly from 37.3 ± 16.6 to 17.6 ± 12.4 ($p < 0.001$). There were no cases of progressive implant loosening where revision surgery was required by the time of the final follow-up. X-ray measurements showed the improved coronal alignments and the appropriate implant installation angles. Regarding PF overstuffing, 47 out of 55 knees had an increased PF height postoperatively. The value of TOS was 2.3 ± 2.2 mm. When evaluating the effects of TOS on clinical outcomes, no significant association was observed between TOS and knee ROM at 2 years after surgery and at the final follow-up (2 years postoperatively; $rs = 0.145$, $p = 0.316$, final follow-up; $rs = -0.005$, $p = 0.976$). On the other hand, postoperative total 2011KSS was significantly correlated with the degree of TOS at 2 years after surgery (Figure 2A), as opposed to no correlation at the time of the final follow-up (Figure 2B).
DISCUSSION: Modular unlinked BiKA provided patients with a high level of satisfaction and functional improvement over 5 to 9 years postoperatively. We performed BiKA using third-generation implants, only after having carefully considered operative indications. Recently, Goh et al.[1] reported that clinical outcomes in the BiKA group were comparable to those in the TKA group 10 years after surgery. They also carefully decided the operative indication and concluded that BiKA could be considered a suitable alternative to TKA in select groups of patients. BiKA preserves the lateral compartment of the TF joint, and small implants used in BiKA minimizes the amount of bone removed during surgery and the alteration of the native joint. While BiKA has these advantages, this surgery has not been performed on severe genu varum or ACL-deficient knees to minimize the risk of failure in this study. In such cases, even if the lateral compartment is intact, TKA may still be necessary due to its broad surgical indication and consistent postoperative outcomes. Thus, we consider that selecting the appropriate operative indication is one of the crucial points for achieving a successful outcome after BiKA. Regarding overstuffing of the PF joint, two years after the operation, higher degree of overstuffing was associated with worse patient satisfaction, meaning that the overstuffing of the PF joint affected patient satisfaction in the early stages after the operation. In the knee joint, the separate contraction of the quadriceps femoris in the mild flexion position causes anterior drawing force in the tibia [2], and the ACL is the primary restraint for that force. In TKA where the ACL is removed, if overstuffing occurs in the PF joint, it may be difficult to develop symptoms because the pressure in the PF joint decreases due to the anterior movement of the tibia [3]. However, in BiKA, since all ligaments including the ACL are preserved, it is impossible to decompress the PF joint by anterior movement of the tibia. The effect of increased PF pressure due to overstuffing on postoperative symptoms may appear more prominently than TKA. We found that PROMs was low when the degree of PF overstuffing was strong 2 years after surgery, but this correlation was not observed 5 years or more postoperatively. In it possible that cases in which the knee extension mechanism and patellar retinaculum potentially adapted over time after surgery. Hence, we consider that avoiding postoperative PF overstuffing is important for enhancing patient satisfaction during the early postoperative period.
SIGNIFICANCE: Since PF overstuffing affects the subjective evaluation at 2 years after surgery, attention should be paid not only to placement position, angle, and alignment, but also to the amount of osteotomy during surgery to improve postoperative satisfaction in the early stages after BiKA.
REFERENCES:[1] *Goh. 2020 The Knee.* [2] *Yasuda K. 1987 Clin Orthop Relat Res.* [3] *Ishii Y. 2017 Knee Surg Sports Traumatol Arthrosc.*
IMAGES AND TABLES

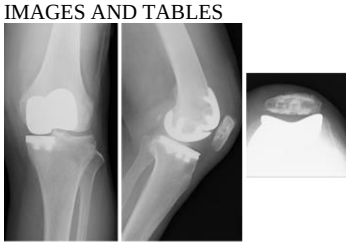

Figure 1. Radiographs after BiKA

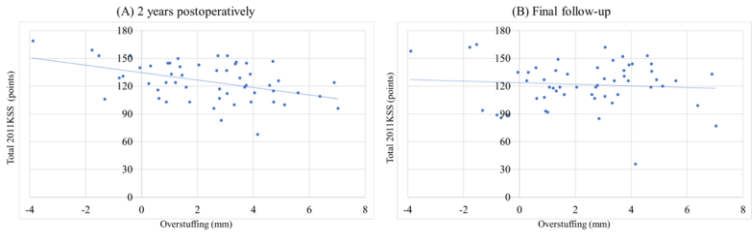

Figure 2. Total 2011KSS and overstuffing at 2 years postoperatively (A) and final follow-up (B)
(A) Higher degree of overstuffing was significantly correlated with worse total 2011KSS score ($rs=-0.387$, $p=0.004$).
(B) No significant correlation was found between the degree of overstuffing and total 2011KSS score ($rs=0.068$, $p=0.623$).