

Dear Professor,

Thank you very much for your valuable and constructive comments and suggestions pertaining to our manuscript (NO:70019) titled "Modified treatment of Knee Osteoarthritis Complicated with Femoral Varus Deformity:A Case Report".

We have studied your comments carefully and have made revision which marked in red in the paper. We have tried our best to revise our manuscript according to the comments. Our responses to individual comments are also reproduced below for your reference.

Looking forward to hearing from you.

Thank you and best regards.

Yours sincerely,

Gui-Shan Gu

Response to Reviewer 1

Comment :Scientific Quality: Grade C (Good)

Language Quality: Grade B (Minor language polishing)

Conclusion: Major revision

Specific Comments to Authors: The paper is concise and informative. The title is informative and relevant. The references are relevant and recent. The cited sources are referenced correctly. Appropriate and key studies are included. The introduction reveals what is already known about this topic. The research question is clearly outlined. The case is well-described, the used methods methods for diagnosing and therapy are valid and reliable. The patient data is presented in an appropriate way. The illustrative materials are relevant and clearly presented. Data is discussed from different angles and placed into

context without being overinterpreted. The article is consistent within itself. Specific comments on weaknesses of the article and what could be improved: Major points - none Minor points - However, the authors should revise the discussion and to make it more clearer. It is not clear what are the main findings, the pearls for the clinical practice and the uniqueness of the case.

Response: Thank you for your valuable suggestion. In our study, simultaneous total knee arthroplasty (TKA) combined with supracondylar osteotomy without plate was used for treatment of KOA complicated by femoral varus deformity. Different from several commonly used treatment methods, this surgical method has the following advantages: 1. The treatment period is short. Compared with the two-stage operation, single-stage surgical intervention can reduce the surgical damage to patients, accelerate recovery time, and avoid the risks that secondary anesthesia poses to patients; 2. The fixation method of osteotomy end was modified. Using intramedullary fixation with extended rods also avoids a series of internal fixation complications caused by plate fixation applied after osteotomy, as the plates require larger incisions and greater soft tissue destruction, which are unfavorable for bone healing at the osteotomy end; 3. The economic burden on patients was reduced. The problem is solved for patients in terms of both clinical efficacy and economic cost. This surgical approach provides a feasible choice for the surgical treatment of KOA combined with extra-articular deformities. The "Discussion" section has been revised as follows:

DISCUSSION

For advanced KOA, surgery is the most effective treatment. However, for patients with KOA with extra-articular deformities, the choice of surgical approach, especially the corrective osteotomy and total knee replacement as a single-stage or two-stage procedure, remains controversial [3]. The following treatment modalities are usually chosen: (1) plate fixation after a simple femoral or tibial osteotomy^[4,5]; (2) treatment with TKA (intra-articular

compensatory osteotomy); (3) staged corrective osteotomy and delayed TKA; and (4) simultaneous total knee replacement combined with plate compression fixation after osteotomy. These four surgical procedures are aimed at a fixed population and all have good clinical outcomes, but there are also some deficiencies. The first modality is appropriate for delaying the patient's years of joint replacement, but is appropriate for younger patients with less severe OA. The second modality requires asymmetric intra-articular osteotomy and ligament balancing to correct lower extremity force lines, but is limited by the site and severity of deformity, which is often ineffective for severe extra-articular deformities^[6]. The third modality prolongs patient hospitalization and recovery time, increases the number of procedures, and also increases the odds of incisional infection and economic burden. The fourth procedure performed better than the previous several, especially for KOA with a deformity angle $> 20^\circ$, which avoids excessive osteotomy within the joint and restores the lower limb force lines ^[7,8], but it increases the economic burden as well as the risk of possible consolidation with plate implantation.

From the perspective of patients, a single-stage operation should be a priority. In this case, the preoperative data showed that the patient had a femoral varus deformity ^[9], and the angle of the deformity was 17° . Although it has been reported that KOA with extra-articular deformities $< 20^\circ$ on the coronal plane can be compensated by increasing intra-articular osteotomy^[10], compensatory osteotomy may cause iatrogenic ligament instability. Patients with medial collateral ligament contracture and lateral collateral ligament relaxation need soft tissue release during the operation, which further increases the probability of iatrogenic ligament injury or instability. Therefore, extra-articular osteotomy is considered to correct the deformity. Kyung *et al* pointed out that the incidence of postoperative hinge fracture in single-plane tibial wedge osteotomy is lower than that in double-plane tibial osteotomy ^[11]. It has also been documented that patients with varus deformity tend to retain

residual deformity within $0 \pm 3^\circ$ postoperatively, contributing to functional improvement and increased prosthetic life [12]. Therefore, the upper edge of the supracondylar patella of the femur was selected to maintain a 15° valgus angle for a single-plane wedge osteotomy.

As for the internal fixation method of osteotomy site, there is no significant difference between plate fixation and intramedullary fixation in reoperation rate [13]. However, it has been reported that the extension rod plays a role in the treatment of prosthesis loosening, bone mass difference and fracture morphology, and can improve the stability of periprostheses fracture revision surgery. Stability provides better opportunities for early mobilization and long-term osseointegration [14]. The femoral side application of prosthesis extension rods in ensuring length belongs to intramedullary fixation, differing from the eccentric fixation of plates, which guarantees mechanical stability, and allows early functional exercise of patients.

Compared with the two-stage operation, single-stage surgical intervention can reduce the surgical damage to patients, accelerate recovery time, and avoid the risks that secondary anesthesia poses to patients. Meanwhile, using intramedullary fixation with extended rods also avoids a series of internal fixation complications caused by plate fixation applied after osteotomy, as the plates require larger incisions and greater soft tissue destruction, which are unfavorable for bone healing at the osteotomy end. The problem is solved for patients in terms of both clinical efficacy and economic cost. Using TKA alone, which achieves the two purposes of extra-articular osteotomy and KOA treatment, has rarely been reported in previous studies. However, the use of simultaneous TKA with extra-articular osteotomy is technically difficult. It requires the surgeon to be skilled in the techniques involved in knee revision arthroplasty.

This surgical approach has some limitations and cannot be applied to all knee deformities. Precise surgical protocols should be developed based on detailed evaluation of different individual cases. However, this surgical

approach provides a feasible choice for the surgical treatment of KOA combined with extra-articular deformities. This is only a preliminary report, and studies with a higher level of evidence must be performed to validate our findings.

Once again, thank you very much for your comments and suggestions.