Burring technique is more reproducible for the tibial component placement in the robotic assisted TKA than bone saw technique

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INTRODUCTION: Total knee arthroplasty (TKA) has been reported that it has long sufficient clinical results for the treatment of severe knee osteoarthritis (OA). To obtain better clinical results and knee kinematics of TKA, accurate bony resection and normal joint gap reproducibility are needed. In the knees of severe valgus or varus deformity, in post-traumatic knee OA, in subjects of severe obesity, and in the revision surgery, it is sometimes difficult to perform accurate bony resection and obtain better joint gap by the manual surgery. In robotic assisted total knee arthroplasty (TKA), accurate implant placement and gap balancing have been reported [1]. Regarding the techniques used in robotic assisted TKA (CORI, Smith and Nephew, Co., Ltd, Boston MA, USA), there are two methods for tibial osteotomy: a broaching technique using a pressurizing bar and a method utilizing a bone saw. The purpose of this study was to compare the tibial implant placement reproducibility between these broaching with bone bar and bone saw techniques in the robotic assisted TKA.

METHODS: Twenty-eight subjects (21 female and 7male: average age 75±8) those tibial bone were resected with burring technique in robotic assisted TKA (BR group) and forty-six subjects (41 female and 5male: average age 77±9) those tibial bone were resected with bone saw (BS group), were included in this study. Pre-operative diagnosis was medial knee osteoarthritis more severe than Kellgren-Lawrence grade III. Exclusion criteria were, history of knee surgery, history of knee trauma, and diagnosis except for knee OA, such as rheumatoid arthritis or knee osteo-necrosis. All surgery were performed by a single surgeon (K.S.) with robotic assistance (CORI, Smith and Nephew, Co., Ltd, Boston MA, USA). Journey II BCS-TKA (Smith and Nephew, Co., Ltd, Boston MA, USA) was used for all subjects. Knee radiograph was taken both in coronal and sagittal plane just after surgery. Statistical analysis was performed to compare the varus/valgus angle, posterior slope tibial implant alignment, between pre-operative planning and post-operative knee radiograph in each group. BR and BS group comparison was performed for the implant angle difference pre-operative planning and post operative radiograph both in coronal and sagittal plane (Mann-Whitney's U test).

RESULTS SECTION: In the BR group, the coronal angle was 2.25° varus in pre-operative planning (range: 0°–3°), and 2.03° varus post-operatively (range: 0°–4°). The sagittal slope was 5.18° pre-operatively (range: 3°–7°) and 4.92° post-operatively (range: 3°–7°). In the BS group, the coronal plane angle was 2.08° varus in pre-operative planning (range: 0°–3°), and 2.13° varus post-operatively (range: 0°–4°). The sagittal plane posterior slope angle was 5.26° pre-operatively (range: 3°–6°) and 3.41° post-operatively (range: 1°–6°).
The difference between pre-operative planning and post-operative evaluation in the coronal plane in the BR and BS groups were, -0.19±1.21° and 0.04±0.59° , respectively. The difference between pre-operative planning and post-operative evaluation in the sagittal plane (tibial posterior slope) in the BR and BS groups were, -0.26±1.06°and -1.85±1.09°, respectively. Significantly better reproducibility was shown in the BR group in the sagittal plane evaluation ($p<0.05$).

DISCUSSION: Using CORI allows intraoperative visualization of gap balance, enabling planning of bone cuts accordingly, which makes functional alignment achievable when ideal component positioning is attained. The coronal plane varus/valgus angle showed high reproducibility, whereas the posterior slope angle in the sagittal plane was less consistently reproduced. In comparing the techniques, the broaching method (BR group) resulted in a higher reproducibility of the posterior slope angle. It appears that broaching technique allows for more precise tibial bone cuts compared to the bone saw technique in the robotic assisted TKA.

SIGNIFICANCE/CLINICAL RELEVANCE:
In the robotic assisted TKA, broaching technique with bone bar showed significantly better reproducibility of tibial component placement when compared with bone saw technique. To reproduce the pre-operative planning of tibial component placement in the robotic assisted TKA, bone bar use would be preferable.

REFERENCES: [1] Adamska et al. Medicina (Kaunas) 2023.

Figure 1. Bone bar (A)and bone saw (B) in the robotic assisted TKA (CORI)

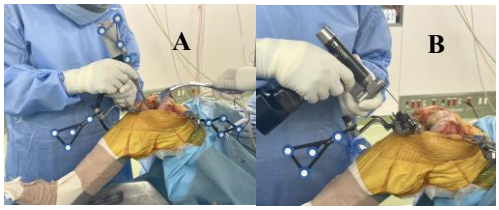

Figure 2. Tibial component placement angle in the pre-operative planning and post-operative radiograph

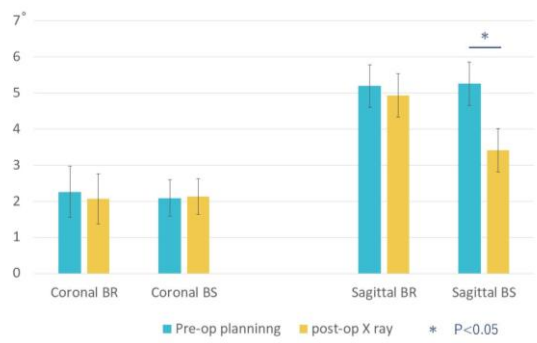

Figure 3. Difference of the tibial component angle between pre-operative and post-operative radiograph