The extension and flexion gap can be changed after bone cutting in total knee arthroplasty

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Introduction: Accurate soft tissue balancing and symmetrical gap in extension and flexion are important factors for successful TKA. Usually, surgeon performs preliminary sofr tissue release and osteotomizes the bones according to the flexion and extension gap after soft tissue balancing. It is possible that gap balance can be changed after bone cutting. The purpose of study is to evaluate the effect of bone cutting on extension and flexion gap during the procedure of TKA.

Methods: 32 consecutive TKAs for primary osteoarthritis were performed by single surgeon (MCL), using E-motion UC implant system (Aesculap). We have measured medial and lateral gap in extension and flexion before and after bone cutting by means of the Orthopilot navigation system (Aesculap), and evaluated the stability with intraoperative varus and valgus stress test after implantation. Postoperatively, we have measured the femoral component rotation and alignment on plain radiograph and CT on the basis of clinical transepicondylar axis. We defined the outlier as excessive rotation more than 3 degrees.

Results: Extension medial and lateral gap increased by 0.8mm significantly (-2.5 to 4.5, p=0.009) and 0.5mm insignificantly (-2.5 to 4.5, p=0.121) respectively after bone cutting. 4 knees (13%) increased and 1 knees (3%) decreased by more than 2mm in extension medial gap; 7 knees (22%) increased and 3 knees (9%) decreased by more than 2mm in extension lateral gap. The difference between lateral and medial extension gap in planning was average 1.3mm, but 9 knees (28%) showed asymmetrical extension gap with more than 2mm difference. This asymmetrically planned 9 cases were changed to be symmetrical after bone cutting except for 4 cases. These 4 cases were all stable (less than 2°) in intraoperative varus and valgus stress test. Flexion medial and lateral gap increased significantly by 1.6mm (-2 to 10.5, p=0.003) and 1.0mm (-3 to 2, p=0.009) respectively after bone cutting. 9 knees (28%) increased by more than 2mm in flexion medial gap and 7 knees (22%) did so in flexion lateral gap. No knee decreased by more than 2mm in flexion medial and lateral gap. Average of femoral external rotation was 3.5° (0 to 8°) in planning and 1.3° (-2.9 to 4.2°) in postoperative CT (p=0.003, r=0.534). 5 knees showed excessive external rotation with more than 3° but there was no knee which showed excessive internal rotation. 2 knees showed asymmetrical flexion gap with more than 2mm difference but these showed acceptable external rotation.

Discussion & Conclusion: The femoral bone cutting in TKA resulted in various change of gap along with soft tissue tensioning. About 2mm mediolateral extension gap difference in coronal alignment on planning can be accepted because medial side is increased to get symmetrical and stable gap after bone cutting. In flexion gap balancing, surgeon should avoid excessive external rotation of femoral component to get symmetrical flexion gap by permitting 2mm mediolateral flexion gap difference. Also surgeon should take care not to release soft tissue excessively before bone cutting. Conclusively, we found that the extension and flexion gap can be changed after bone cutting in total knee arthroplasty but the result is not enough to take effect on the stability of prosthesis.