

Results of Total Knee Arthroplasty Using Ligament-specific Navigation-assisted Gap Balance Technique

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INTRODUCTION

As advancements are made in the field of total knee arthroplasty (TKA) with respect to instrumentation, implants, surgical techniques and use of computer assistance, the indications for TKA continue to expand and functional expectations continue to rise. However the most important factors affecting the outcome of a TKA are restoring the normal mechanical axis and achieving optimum soft tissue balance. Debate still exists on the choice of surgical technique to achieve the optimal soft tissue balance with opinions divided between the measured resection technique and the gap balance technique. Described by Hungerford et al, in the measured resection technique the bone resection depends on size of the prosthesis and is referenced to fixed anatomical landmarks. Soft tissue is then secondarily balanced to obtain symmetrical flexion-extension gaps. This technique however may have accompanying problems in imbalanced patients. Secondly individual variability of the reference points may affect the alignment of the bony cuts and thereby the alignment of the implant. The gap balance technique initially described by Freeman and later modified by Insall et al blends the soft tissue balance with the bony cuts and tries to overcome this problem. However proponents of the measured resection technique argue that no consideration is given to the coronal and rotational alignment of the femoral component in the gap balance technique. The ligament specific navigation assisted gap balance technique, tries to overcome these fallacies. The lateral ligaments and soft tissues (in case of OA knee with varus deformity) act as a reference against which the medial soft tissues are balanced. Thus the reference becomes individualized and any variability is taken care of. Navigation assistance ensures control of the coronal and rotational alignment of the femoral component.

The aim of the present study was twofold: - To describe our methodology of ligament specific navigation assisted gap balance technique and analyze the clinico-radiological outcome of our technique over an eight year follow up.

Materials and Methods

Seventy nine patients (98 knees) with a diagnosis of primary osteoarthritis with varus deformity $<20^{\circ}$ and flexion deformity of $<25^{\circ}$ operated with our technique were followed up for an eight year duration. After obtaining an optimum gap balance and neutral axis in extension, tibial osteotomy perpendicular to the mechanical axis in both the coronal and sagittal planes was done. At this stage joint gaps were distracted in extension and 90° flexion. Based on the gap values patients were classified into three groups. Group 1 was the balanced group with flexion extension gap difference $\leq 2\text{mm}$, group 2 was the flexion tight group with flexion gap smaller than the extension gap by $\geq 3\text{mm}$ and group 3 was the extension tight group with the extension gap smaller than the flexion gap by $\geq 3\text{mm}$. Thereafter flexion gap balance was achieved only by adjusting the cutting levels of the distal and posterior condyles and adjusting the axial rotation of the femoral component without any further soft tissue release. Intra operative navigation readings were recorded. All patients were followed clinico-radiologically at 1, 4, and 8 years post operatively.

Results

The level of posterior condylar cut was significantly higher in the flexion tight group. The level of distal cut was higher in the extension tight group. Mean external rotation of the femoral component was 3.14° . Mean joint line change in all patients was $< \pm 2.5\text{mm}$. There was significant improvement in all the clinical scores, and ROM till the last follow up. No major complications were noted. There were no differences among the patients in the three groups.

Conclusion

The ligament specific navigation assisted gap balance technique is a reliable technique for TKA with excellent clinico-radiological results over an eight year follow up period.

Reference

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- 2) T. Luyckx, T. Peeters, H. Vandenneucker, J. Victor, J. Bellemans. Is adapted measured resection superior to gap-balancing in determining femoral component rotation in total knee replacement?. J Bone Joint Surg Br 2012;94-B:1271–76.