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Accuracy and a learning curve of an accelerometer-based computer navigation in total knee arthroplasty

Hirotake Yo, Tessyu Ikawa, Yoshito Minami

Osaka Saiseikai Nakatsu Hospital, Osaka, Japan

yangyang1968@hotmail.com

Abstract

The aim of this study was to investigate the accuracy in performing a femoral resection and the existence of a learning curve in conducting TKA using the KneeAlign2 system. 86 primary TKAs were enrolled in this prospective study. These patients were divided in two groups. Group1: patients operated by surgeon of experience using the KneeAlign2 system more than 30 cases. Group2: patients operated by surgeons of experience using the KneeAlign2 system less than 30 cases. The radiographic results (alignment of the femoral component) and operation time were compared between the groups. There were no significant differences between the groups. The KneeAlign2 system provides usefulness in performing an accurate distal femoral resection at TKA. As the learning curve does not be observed, this portable navigation system is easy to handle even for less experienced surgeons.

1 Introduction

For the successful outcome of total knee arthroplasty(TKA), femoral component malalignment remains significant concern. Most studies demonstrate alignment to be a crucial factor.¹⁾

The conventional methods using extramedullary and intramedullary alignment guide have demonstrated a limited degree of accuracy for mechanical alignment.²⁾³⁾ The KneeAlign2 system (OrthAlign,Inc., Aliso Viejo, CA) is a portable accelerometer-based navigation device for use in performing the distal femoral resection in TKA.

The aim of this study was to investigate the accuracy in performing a femoral resection and the existence of a learning curve in conducting TKA using this device.

2 Materials and methods

A total of 86 patients with primary osteoarthritis of the knee were enrolled in this prospective study. There were 64 women and 22men . The mean age of the patients was 76.6 years (53 to 89). The KneeAlign2 system was used for distal femoral resection. These patients were divided in two groups.

Group1: patients operated by surgeon of experience using the KneeAlign2 system in more than 30 cases.(42 knees)

Group2: patients operated by surgeons of experience using the KneeAlign2 system in less than 30 cases.(44 knees)

Standing AP hip-to-ankle radiographs were obtained post-operatively. Positioning of the femoral component was evaluated by the radiographs. The varus / valgus alignment of the femoral component was evaluated as follows; the mechanical axis of the femur was determined by drawing a line from the center of the femoral head to the center of the intercondylar notch of the implant; the angle between the femoral mechanical axis and a line connecting the most distal aspects of the medial and lateral femoral condylar was defined as the coronal alignment of the femoral components, the A angle . Outliers in coronal alignment were defined as those with $>\pm 2^\circ$ of varus / valgus.The radiographic results and operation time were compared between the groups. Analyses of the differences between the two groups were undertaken using Student's t-test and Fisher's exact test. Statistical significance was set at $p < 0.05$.

3 Results

There were no significant differences between the preoperative demographics of each group (Table1).

A angle was 89.5 ± 1.17 in group 1, 89.4 ± 1.18 in group2. The mean deviation from the neutral alignment of the femoral component were 1.27 ± 0.59 in group1 and 1.15 ± 0.69 in group2. Outlier $>2^\circ$ was 7% in group 1, 10% in group 2. Average operation time was 103 minutes in group1 and 109 minutes in group2. There were no significant differences between the results of each group (Table2).

	Group 1	Group 2	P-value
age	76.2(63~89)	76.6(53~87)	n.s.
gender	M12 F30	M10 F34	n.s.
BMI	25.6 ± 2.4	26.1 ± 3.8	n.s.

Table1. Preoperative demographics

	Group 1	Group 2	P-value
A angle	89.5 ± 1.17	89.4 ± 1.18	0.92
deviation	1.27 ± 0.59	1.15 ± 0.69	0.74
Outlier $>2^\circ$	7%	10%	0.54
Surgery time	103	109	0.14

Table2. Results

4. Discussion

Nam et al⁴⁾ demonstrated that of the femoral components, 95.7 % were placed within $90^{\circ} \pm 2^{\circ}$ to the femoral mechanical axis. Our study obtained similar results that has no significant differences even compared to less experienced surgeon group. And Nam et al⁵⁾ also demonstrated the comparison of KA-2 system and imageless large-console computer-assisted navigation system (CAS). In the KneeAlign 2 group, 94.9% had a femoral component alignment within 2° of perpendicular to the femoral mechanical axis (vs 92.5% with large-console CAS system, $p < 0.01$). We found that the KneeAlign2 system is portable and easy to handle when compared to large-console CAS system.

The KneeAlign2 system provides usefulness in performing an accurate distal femoral resection at TKA. As the learning curve does not be observed, this portable navigation system is easy to handle even for less experienced surgeons.

5. References

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