Auditing the results of Navigated Total Knee Replacement in Tayside: an early outcome study

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INTRODUCTION

Successful Total Knee Replacement (TKR) depends on many factors, the two most important being post-operative alignment of the limb and component alignment.

Computer navigation aids to improve accuracy of implant positioning, obtaining an overall alignment of the lower limb within ±3° of the true mechanical axis of the limb[1].

AIM

To review the outcome of patients having undergone navigated TKR at Ninewells Hospital, Dundee between January 2006 and November 2009.

OBJECTIVES

- **Review data of navigated TKR patients to draw relevant conclusions.**
- **Establish benefits of navigation in terms of score/ function compared with conventional knee replacement.**

METHODS & MATERIALS

- **A database of all patients who underwent navigation TKR is maintained by Tayside Arthroplasty Audit Group (TAAG).**
- **There were 128 patients in total between January 2006 and November 2009.**
- **Navigation TKR in the current study was done with OrthoPilot® system (Figure 1).**

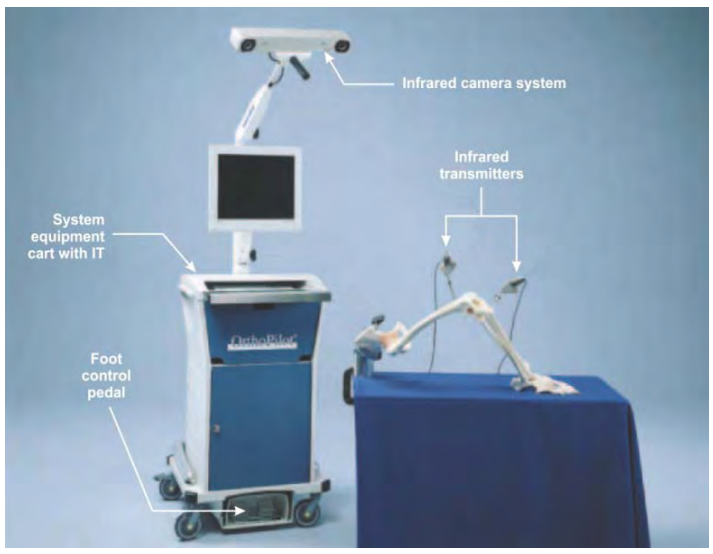


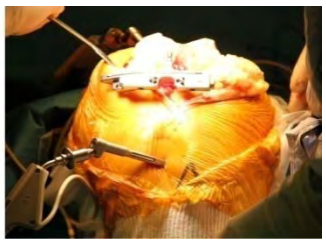
Figure 1 - OrthoPilot® system (adapted from Aesculap brochure[7]).

- **121 patients had Columbus® Cruciate retaining implant, 7 patients had Columbus® Cruciate substituting implant.**
- **All 128 patients completed one-year follow-up and 55 patients had three-year follow-up. Knee Society Score (KSS) was used to assess all patients at each follow-up.**
- **Surgical steps of navigation TKR are shown in Figure 2.**
- **40 navigated TKR patients were compared with 40 patients of conventional TKR after matching demographic parameters and pre-operative deformities.**

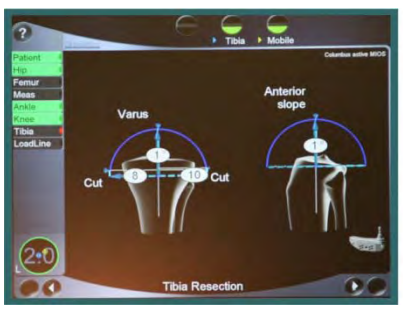
STEP 1

STEP 2

STEP 3

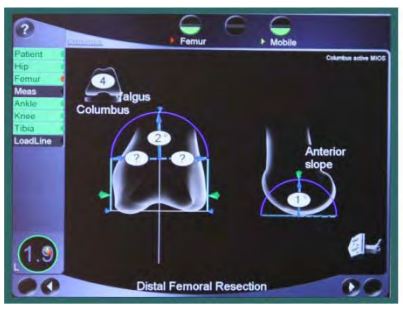


STEP 4



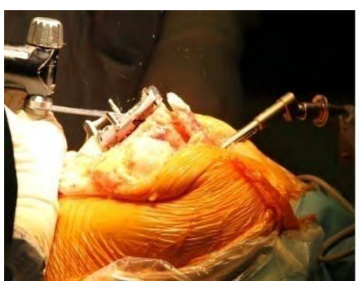
STEP 5

STEP 6



STEP 7

STEP 8



STEP 9

STEP 10

Figure 2 - Surgical steps of navigation TKR. STEP 1 - Tracking devices attached to the femur and tibia; STEP 2 - Pointing instrument digitizing the malleoli; STEP 3 – Tracker placed on tibial guide; STEP 4 - Tibial guide placed for proximal tibial resection; STEP 5 - Monitor showing proposed cut; STEP 6 - Tracker attached distal femoral cutting block; STEP 7 - Monitor showing proposed distal femoral cut; STEP 8 - Guide being fixed in proper rotational alignment; STEP 9 - Femoral cut being taken in progress; STEP 10 - Cementation of femoral component.

RESULTS

- **In this retrospective study, 47 patients were within the age group of 71-80 years, 45 patients within 61-70 years, 20 patients >80 years and 16 patients <60 years of age.**
- **There were 66 female and 62 male patients.**
- **59 patients were obese (body mass index, BMI, between 30-39.9), 48 were overweight (BMI between 25-29.9), 17 were normal weight (BMI between 18.5-24.9) and 4 patients were very obese (BMI >40).**
- **122 patients had osteoarthritis; 5 had rheumatoid, and 1 post-traumatic arthritis. 68 knees were left side and 60 were right side. The mean KSS and Knee Function Scores (KFS) are shown in Figure 3.**

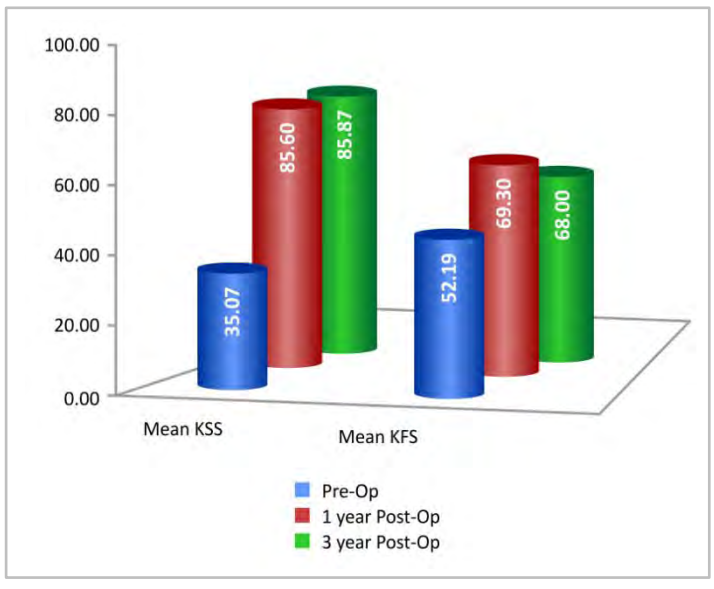


Figure 3 - The mean Knee Society Scores and Knee Function Scores.

- **There were 2 revision TKRs, 8 superficial infections and one death.**
- **Clinical and functional outcome of both groups is shown in Figure 4.**

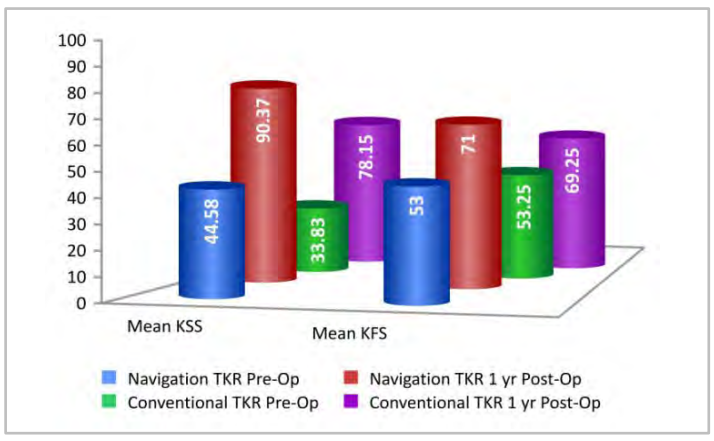


Figure 4 - Pre- and 1-year post-operative KSS and KFS for both groups.

There was no statistically significant difference between both groups in terms of anatomical femoro-tibial alignment, femoral component coronal and sagittal alignment, and tibial component coronal alignment. However there was statistically significant difference (*p=0.000*) between both groups in terms of alignment of tibial component in sagittal plane (Figure 5).

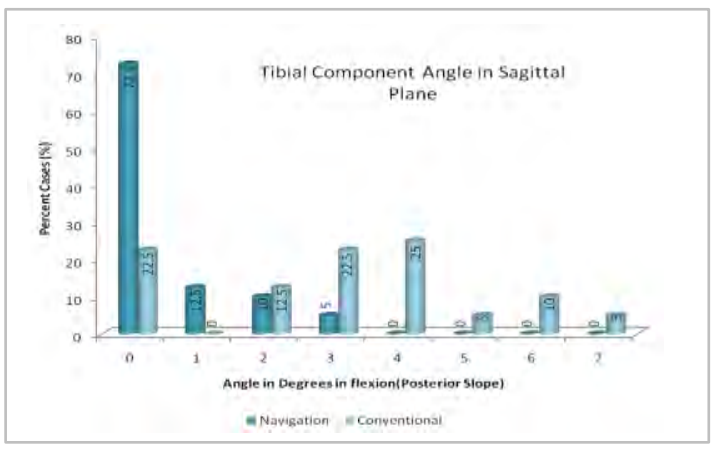


Figure 5 - Tibial component angle in sagittal plane.

DISCUSSION

- **The current study showed statistically significant difference between the KSS of the two groups, however, there was no difference between the KFS.**
- **Similar results have been reported in various studies[2,5,6].**
- **Table 1 shows comparison of various studies looking at radiological parameters.**

Table 1 - Navigated (Nav.) versus Conventional (Con.) TKR.

Author	System	Technique	Study size	Alignment Results (p-value for difference between navigated and conventional TKR)				
				Femoro-Tibial	Femoral component		Tibial component	
					Coronal	Sagittal	Coronal	Sagittal
Jenny & Boeri[4] 2001	Ortho-Pilot	Nav.	30 TKRs	NS	NS	S*	NS	NS
		Con.	30 TKRs					
Hart et al.[3] 2003	Ortho-Pilot	Nav.	60 TKRs	NS	NS	NS	NS	S**
		Con.	60 TKRs					
Cheung & Chiu[2] 2009	Stryker	Nav.	47 TKRs	S**	S**	S**	S**	NS
		Con.	47 TKRs					
Current Study 2011	Ortho-Pilot	Nav.	40 TKRs	NS	NS	NS	NS	S**
		Con.	40 TKRs					

NS= Not Significant, S=Significant, *p<0.05* = S*,*p<0.01* = S**

CONCLUSIONS

Computer navigation TKR affords the possibility to place both femoral and tibial components precisely without risk of any greater axis deviation from the ideal value. It helps in reducing the outliers in alignment of the limb and that of component, which may improve overall implant survival post-operatively.

REFERENCES
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2.**Cheung K, Chiu k** (2009). Imageless computer navigation in total knee arthroplasty. Hong Kong Med J; 15: 353-358.
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4.**Jenny J, Boeri C** (2001). Computer assisted implantation of total knee prosthesis: a case control comparative study with classical instrumentation. Computer aided surgery; 6: 217-220.
5.**Spencer J, Chauhan S, Sloan K, Taylor A, Beaver R** (2007). Computer navigation versus conventional total knee replacement. J. Bone Joint Surgery; 89-B: 477-480.
6.**Stulberg D, Yaffe M, Koo S** (2006). Computer- assisted surgery versus manual total knee arthroplasty: A case-controlled study. J. Bone Joint Surgery; 88: 47 – 54.
7.**Aesculap orthopaedics** Columbus® Knee Endoprosthesis System TKR 4.0 brochure.

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