

KNEE – ACCURACY

Mason J.B. et al. (2007)

- CAS navigation in TKA offers significant improvement in accuracy and reproducibility of component orientation.
- Significantly less mechanical axis malalignment with CAS.

Blakeney W.G. et al. (2011)

- The authors feel CAS provides the most accurate alignment of implants in TKA
- Surgeon reaches significant better outcome using CAS in spite of less experience

Brin Y.S. et al. (2010)

- Imageless CAOS significantly reduces the number of outliers in TKA.
- Reduced outliers rate by approx. 87% (femoral implant position) and 80% (mechanical axis) with outliers defined by deviations $\pm 3^\circ$.



Meta-analysis of alignment outcomes in computer-assisted total knee arthroplasty surgery.

J Arthroplasty, 2007, 22(8), 1097-1106

Mason J.B. et al.

ABSTRACT

Computer-assisted surgery (CAS) has been advocated as a means to improve limb and prosthesis alignment and assist in ligament balancing in total knee arthroplasty (TKA). Thus, we sought to examine alignment outcomes in CAS vs conventional TKA. A systematic review of literature from 1990 to 2007 was performed. Direct comparison of alignment outcomes was performed using random effects meta analyses. Twenty-nine studies of CAS vs conventional TKA were identified, and included mechanical axis malalignment of greater than 3 occurred in 9.0% of CAS vs 31.8% of conventional TKA patients. The risk of greater than 3 malalignment was significantly less with CAS than conventional techniques for mechanical axis and frontal plane femoral and tibial component alignment.

Tibial and femoral slope both showed statistical significance in favor of CAS at greater than 2 malalignment. Meta-analysis of alignment outcomes for CAS vs conventional TKA indicates significant improvement in component orientation and mechanical axis when CAS is used. Key words: computer-assisted surgery, meta-analysis, alignment.

SUMMARY

Meta-Analysis of 29 comparative studies to assess the component alignment outcomes after computer assisted (CAS) versus conventional TKA including 3437 patients in total. The mean chance of malalignment was less using CAS for all analyzed parameters (Mechanical axis, femoral and tibial component alignment, femoral and tibial slope).

CONCLUSION

CAS navigation in TKA offers significant improvement in accuracy and reproducibility of component orientation.

“[...] computer-assisted navigation in TKA offers a significant ($P < .05$) improvement in both the accuracy and reproducibility of prosthetic component orientation for all alignment outcomes at $\pm 2^\circ$ when compared with conventional knee techniques.”

“[...] alignment outcomes for CAS vs conventional TKA indicates significant improvement in component orientation and mechanical axis when CAS is used.”

Significantly less mechanical axis malalignment with CAS.

“[...] a malalignment of greater than 3° occurred in only 9.0% of patients in the CAS TKA group (23 treatment arms) vs 31.8% of patients in the conventional TKA group.”



Computer-Assisted Techniques Versus Conventional Guides for Component Alignment in Total Knee Arthroplasty. A Randomized Controlled Trial.

J Bone J Surg Am. 2011; 93:1377-84

Blakeney W. G. et al.

ABSTRACT

Background: Optimal alignment of the prosthesis in total knee arthroplasty results in improved patient outcomes. The goal of this study was to determine the most accurate technique for component alignment in total knee arthroplasty by comparing computer-assisted surgery with two conventional techniques involving use of an intramedullary guide for the femur and either an intramedullary or an extramedullary guide for the tibia.

Methods: One hundred and seven patients were randomized prior to surgery to one of three arms: computer-assisted surgery for both the femur and the tibia (the computer-assisted surgery group), intramedullary guides for both the femur and the tibia (the intramedullary guide group), and an intramedullary guide for the femur and an extramedullary guide for the tibia (the extra-medullary guide group). Measurements of alignment on hip-to-ankle radiographs and computed tomography (CT) scans made three months after surgery were evaluated. The operative times and complications were compared among the three groups.

Results: The coronal tibiofemoral angle demonstrated, on average, less malalignment in the computer-assisted surgery group (1.91°) than in the extramedullary (3.22°) and intramedullary (2.59°) groups (p = 0.007). The coronal tibiofemoral angle was >3° of varus or valgus deviation in 19% (seven) of the thirty-six patients treated with computer-assisted surgery compared with 38% (thirteen) of the thirty-four in the extramedullary guide group and 36% (thirteen) of the thirty-six in the intramedullary guide group (p = 0.022). The increase in accuracy with computer-assisted surgery came at a cost of increased operative time. The operative time for the computer-assisted surgery group averaged 107 minutes compared with eighty-three and eighty minutes, respectively, for the surgery with the extramedullary and intramedullary guides (p < 0.0001). There was no significant difference in any of the outcomes between the intramedullary and extramedullary guide groups.

Conclusions: This study provides evidence that the implant alignment with computer-assisted total knee arthroplasty, as measured with radiography and computed tomography, is significantly improved compared with that associated with conventional surgery with intramedullary or extramedullary guides. This finding adds to the body of evidence showing an improved radiographic outcome with computer-assisted surgery compared with that following conventional total knee arthroplasty. Level of Evidence: Therapeutic Level I. See Instructions to Authors for a complete description of levels of evidence.

SUMMARY

Within this trial 107 patients with varus deformities were randomly assigned to computer-assisted surgery (Brainlab navigation used), to intramedullary guides for both the femur and the tibia, or to intramedullary guide for the femur and extramedullary guide for the tibia.

Evaluated was amongst others the alignment on radiographs and CT scans three months post-operatively.

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CONCLUSION

The authors feel CAS provides the most accurate alignment of implants in TKA

“This study adds to the body of evidence demonstrating that computer-assisted total knee arthroplasty has better radiographic outcomes than conventional surgery with extramedullary and intramedullary guides.”

“[...] we suggest that computer-assisted total knee arthroplasty should be accepted as providing the most accurate alignment of implants.”

“The coronal tibiofemoral angle demonstrated, on average, less malalignment in the computer-assisted surgery group (1.91°) than in the extramedullary (3.22°) and intramedullary (2.59°) groups (p = 0.007).”



Imageless computer assisted versus conventional total knee replacement. A Bayesian meta-analysis of 23 comparative studies.

Int Orthop 2010 Apr 8; published online

Brin Y.S. et al.

ABSTRACT

We have undertaken a meta-analysis of the English literature, to assess the component alignment outcomes after imageless computer assisted (CAOS) total knee arthroplasty (TKA) versus conventional TKA. We reviewed 23 publications that met the inclusion criteria. Results were summarised via a Bayesian hierarchical random effects meta-analysis model. Separate analyses were conducted for prospective randomised trials alone, as well as for all randomised and observational studies.

In 20 papers (4,199 TKAs) we found a reduction in outliers rate of approximately 80% in limb mechanical axis when operated with the CAOS. For the coronal femoral and tibial implants positions, the analysis included 3,058 TKAs. The analysis for the femoral implant showed a reduction in outliers rate of approximately 87% and for the tibial implant a reduction in outliers rate of approximately 80%. Imageless navigation when performing TKA improves component orientation and postoperative limb alignment.

The clinical significance of these findings though has to be proven in the future

SUMMARY

Meta-Analysis of 23 comparative studies to assess the component alignment outcomes after imageless computer-assisted (CAOS) versus conventional TKA.

In total there were 4063 patients with 4163 TKA surgeries analyzed regarding mechanical axis, femoral and tibial angle. The results of randomized controlled trials were additionally looked at in separate.

CONCLUSION

Imageless CAOS significantly reduces the number of outliers in TKA.

“[...] the use of imageless CAOS for TKA significantly reduces the number of outliers in the limb mechanical axis and coronal position of the implants by a rate of approximately 80%.”

Reduced outliers rate by approx. 87% (femoral implant position) and 80% (mechanical axis) with outliers defined by deviations $\pm 3^\circ$.

“Analysing the femoral implant position revealed 280 (18.4%) patients in the conventional group that had outliers in femoral implant position, compared to 48 (3.1%) in the CAOS group. The meta-analysis estimated better results with the CAOS TKA [implying] a strong effect with reducing the outliers rate by approximately 87% when using the CAOS.”

(continued...)

“There were 390 (18.6%) outliers for the mechanical axis in the conventional group compared to 92 (4.3%) in the CAOS group. The meta-analysis estimated [...] a strong effect, with CAOS reducing outlier rate by approximately 80%.”