Research Journal of Medical Sciences 1 (3): 178-182, 2007

Clinical Results of Navigated Total Knee Arthroplasty in Patients with Posttraumatic Deformity and Arthrosis

[1,2]A.P. Schulz, [2]S. Magerlein, [2]S, Fuchs, [2]A. Unger, [1]L. Simon,
[1]B. Kienast, [2]M. Faschingbauer and [1,2]A. Paech
[1]BG Trauma Hospital Hamburg, Abteilung Unfall-und
Wiederherstellungschirurgie, Germany
[2]Department of Musculosceletal Medicine,
Campus Lübeck, University Hospital Schleswig-Holstein, Germany

Abstract: Trauma surgeons are often less exposed to large caseloads of primary osteoarthritis, compared to purely "elective"orthopaedic surgeons. The experience in total knee arthroplasty is thereby markedly On the other hand, posttraumatic knee arthrosis is often accompanied by severe deformity and axis deviation. In theory, navigated arthroplasty can overcome some of the problems in this setting. Aim was the evaluation of the navigated technique of Total Knee Arthroplasty (TKA), including the technical difficulties, the learning curve and the feasibility in severe bony deformity. Setting is a level I trauma center. Patients and Methods: Between July 2004 and December 2005 we treated 49 patients with a mean age 62 years. (32-82). All had a severe Arthritis of the knee joint due to trauma (diagram 1), 58% were male, in 51% the treatment was under the Workers injury compensation scheme. On average patients had 3.02 previous operations (1-9, including arthroscopies). In all cases a navigational system (PRAXIM, Tronche/France) was used with infrared-tracking and bone-morphing software. The implant was a mobile bearing LCS knee (DePuy/USA). Study setup was prospective, follow up on average 14.5 months (11-25) including the Knee Society Score results, In 4 cases the procedure was finished in a conventional technique, reasons were decision of the surgeon, a missing femoral cut block and a broken screw of the tracker-fixation. In one case a hinged prosthesis was implanted due to instability. There was no failure of the navigational system. There was a clear learning curve. Preoperative extension deficit was improved from average 7.1° (0-30°)-1.67° (0°-10°) postop., flexion contracture improved from av. 95°-103°. The combined knee society score improved from 83 points preoperatively to 157 points at F/U. Navigated knee endoprosthesis is reliable tool for the trauma surgeon with few technical problems. Especially for surgeons with less experience in TKA, planning of implant size and position is very helpful. With posttraumatic deformity the surgeon can gain valuable information and assistance to improve alignment and ligamentous balancing.

Key words: Arthritis knee joint, posttraumatich deformity, total joint arthroplasty, nacigation, computer assisted surgery

INTRODUCTION

Compared to our colleagues that perform purely elective orthopaedic surgery, trauma surgeons are often confronted with a wide range of different procedures over the year. Thereby we tend to have a relatively small caseload of arthroplasty. The cases a trauma surgeons treats are in a high percentage (>50%) based on post-traumatic arthrosis (Schulz *et al*., 2007). Posttraumatic deformities are often complex and sometimes include multiaxial deviations. Also the soft tissue situation is often poor. There might be instability due to ligamentous injuries; indwelling metal work has sometimes to be removed (Schulz *et al*., 2006). Navigational systems have been introduced in orthopaedic surgery to assist in implant seating and thereby improve the axis alignment. General aim of this systems is to improve long term results, especially regarding function and revision rates (Clemens and Miehlke, 2003; Hart *et al*., 2003; Bathis *et al*., 2004, 2005). Furthermore, navigation is of great assistance in the minimal invasive implantation of knee endoprostheses (Perlick *et al*., 2004).

The aim of this study, was to assess the benefits of navigation in posttraumatic arthrosis (Fig. 1) with a focus on the learning curve, intraoperative complications due to the system and early functional results.

Corresponding Author: A.P. Schulz, Department of Musculosceletal Medicine,Campus Lübeck, University Hospital Schleswig-Holstein, Germany

Fig. 1: Examples of cases treated in this series. Here both with severe arthritis after distal femoral fracture

MATERIALS AND METHODS

Between July 2004 and December 2005 we treated 49 Patients with a mean age of 62 years (32-82 years). Age at trauma was mean 39 years (13-66 years). All had a severe Arthritis of the knee joint due to trauma (Fig. 2), 58% were male, in 51% the treatment was under the workers injury compensation scheme. The right knee was injured 24 times. On average patients had 3.02 previous operations (1-9, including arthroscopies).

Further injuries in the same accident were sustained by 16 patients; these are detailed in Fig. 3.

The navigational system used is manufactured by PRAXIM (La Tronche/France) (Fig. 4). It uses infrared-tracking and bone-morphing software (Fig. 5). By this a large series of surface points of the patients is taken and with a specific algorithm can be used to create a 3D model (Stindel *et al*., 2002). The implant was a mobile bearing LCS knee (DePuy/USA) in all cases. Retropatellar resurfacing was not used in primary procedures. In 23 cases both components were cemented, in 19 cases a hybrid technique with a cement free implanted femoral shield was used. In 7 cases the implantation technique was completely cement free due to age of the patients.

We used an anterior approach, Torniquet, two Redon-drains for 48 h and single shot antibiotic prophylaxis. Prolonged antibiosis was used in cases with wound infection in the history (12 cases). The follow up period was mean 11.5 months (4.5-31 months). Follow up included radiographs in antero-posterior (a.p.) and lateral projection on long (20×40 cm) film with the a.p. projection

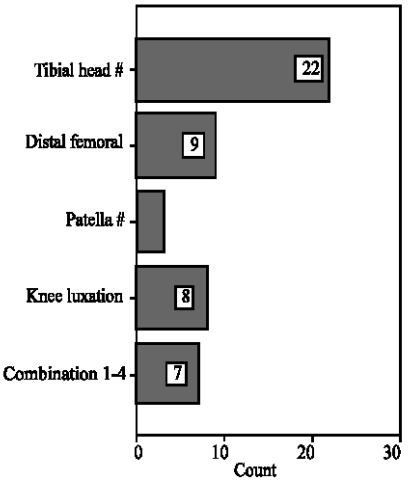

Fig. 2: Injuries leading to arthritis

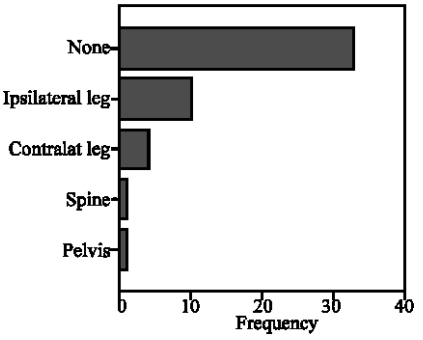

Fig. 3: Further injuries at the time of knee trauma

Fig. 4: The optimal cuts and the seating of the prosthesis are displayed in virtual reality, all factors can then be altered by the surgeon

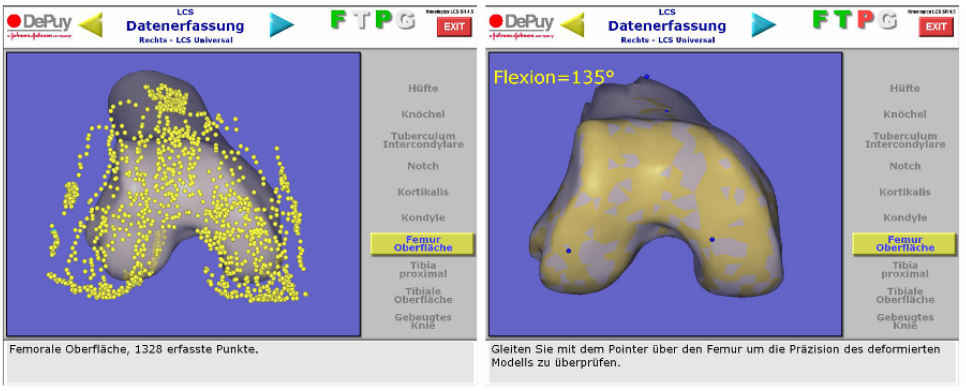

Fig. 5: With a so called "bone morphing" surface points of the patients anatomy are taken and processed into a 3D model

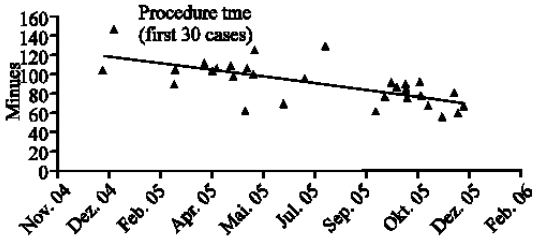

Fig. 6: Development of procedure duration over the study period (learning curve)

fully weight bearing, clinical examination and the Insall knee society scores (Insall *et al*., 1989).

No minimally invasive techniques were applied in this study. For 2 weeks partial weight bearing with 20 kg and 60° maximal flexion, then 2 weeks 90° was enforced. Study setup was prospective, follow up period on average 14.5 months (11-25 months). Follow up examination was not involved in the curve (Fig. 6).

RESULTS

The mean "Cut to Stitch" time was measured between 55-145 min (av. 91). There was a clear learning curve (Fig. 6).

Four times (8.1%) the navigation was terminated:

- Surgeon was suspicious about suggested cuts
- A tracker fixation screw broke
- Femoral cut block was missing on tray
- Procedure converted to constrained TKA due to instability

There was no failure of system hard- or software as complications we saw two cases of DVT, one case

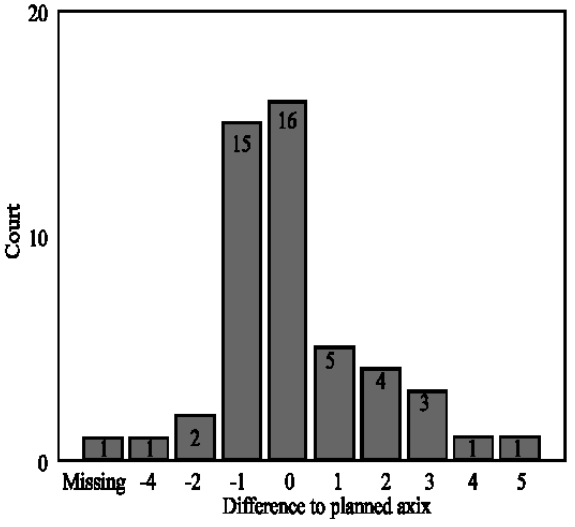

Fig. 7: Postoperative axis deviation as compared to preoperative measurement

of wound infection (conservative treatment), one wound haematoma (revised with mini-arthrotomy at 4th postoperative day and one case of arthrofibrosis with loosening of the femoral shield (cement free, changed to cemented). In two cases a retropatellar implant was required at 5 and 11 months due to retropatellar pain. During the follow up period there was thereby a revision rate of 8.2%.

Preoperative a.p. deviation was measured from 30° valgus to 22° varus (49% varus, 43% valgus) on a.p. radiographs. Postoperatively >90% of knee axis were within 2° of the ideal axis as determined by the system (Fig. 7), overall the deviation from the ideal axis was 2.4%.

The extension deficit improved from 10,4° (0-30°)-1,6° (0-10°). The flexion improved from mean 94° (30-120°)-102° (70-125°). The preoperative Knee Society Score (KSS) was mean 20 points (0-60), the KSS at follow up was

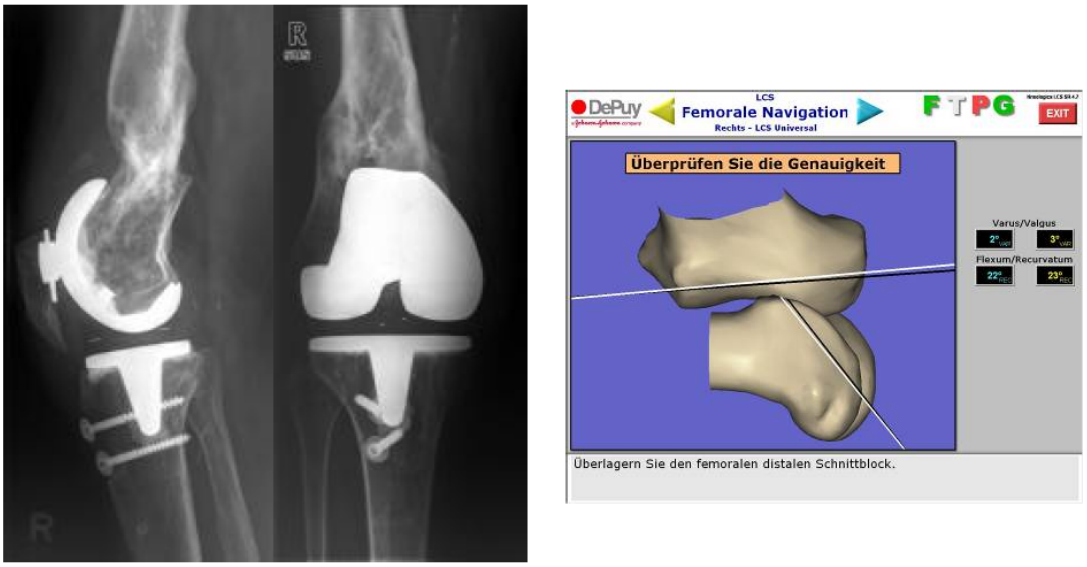

Fig. 8: Severe axis malalignment after distal femoral fracture, in this case the bone morphing had to be repeated 3 times before a reliable result was aquired

mean 76 points (42-95). The mean functional Knee score was preoperatively 46 pts (18-79), compared to postop mean 78 pts (47-100). The combined Insall score at follow up was measured 154 points. The combined Knee Society Score improved mean by 87.7 points (19-152) (Fig. 8).

CONCLUSION

In studies investigating results of TKA for reasons other than posttraumatic deformity, the postoperative Knee society scores are generally determined between 160 to 185 points, so clearly better than the 154 points we found on average in our patients (Hart *et al*., 2003; Morgan-Jones *et al*., 2003; Decking *et al*., 2005). Evaluating the results of these studies we found a mean improvement of pre-to postoperative score of 71-93 points. In our study this was determined with 87.7 points. We can conclude that results of TKA for posttraumatic arthrosis are inferior to TKA for other indications but the improvement step is equal.

Regarding the axis alignment we were able to achieve a deviation of 2,4° of the ideal axis in the a.p.plane. In studies investigating the conventional technique, deviation of between 6-8° are reported (Jenny and Boeri, 2001; Anderson *et al*., 2005; Zorman *et al*., 2005; Weinrauch *et al*., 2006).

Modern navigational systems can master even complex deformity; the navigation is a helpful tool in TKA for posttraumatic deformity. It is known that in posttraumatic knee arthrosis considerable impairment regarding soft tissues, bone quality and axes can be expected (Weiss *et al*., 2003; Schulz *et al*., 2005; Wu *et al*., 2005). There is a considerable learning curve of the procedure. It is so far not clear if there is a long term benefit by this technique.

REFERENCES

Anderson, K.C. and K.C. Buehler *et al*., 2005. Computer assisted navigation in total knee arthroplasty: Comparison with conventional methods. J. Arthroplasty, 20: 132-138.

Bathis, H. and L. Perlick *et al*., 2004. Radiological results image-based and non-image-basd computer-assisted total knee arthroplasty. Int. Orthop., 28: 87-90.

Bathis, H. and L. Perlick *et al*., 2005. Intraoperative cutting errors in total knee arthroplasty. Arch. Orthop. Trauma Surg., 125: 16-20.

Clemens, U. and R.K. Miehlke, 2003. Experience using the latest OrthoPilot TKA software: A comparative study. Surg. Tech. Int., 11: 265-73.

Decking, R. and Y. Markmann *et al*., 2005. Leg axis after computer-navigated total knee arthroplasty: A prospective randomized trial comparing computer-navigated and manual implantation. J. Arthroplasty, 20: 282-288.

Hart, R. and M. Janecek *et al*., 2003. Total knee arthroplasty implanted with and without kinematic navigation. Int. Orthop., 27: 366-369.

Insall, J.N. and L.D. Dorr *et al*., 1989. Rationale of the Knee Society clinical rating system. Clin. Orthop. Relat. Res., 248: 13-14.

Jenny, J.Y. and C. Boeri, 2001. Computer-assisted implantation of total knee prostheses: A case-control comparative study with classical instrumentation. Comput. Aided. Surg., 6: 217-20.

Morgan-Jones, R.L. and G.J. Roger *et al*., 2003. Meniscal bearing uncemented total knee arthroplasty: Early clinical results at a minimum 2-year review. J. Arthroplasty, 18: 41-44.

Perlick, L. And H. Bathis *et al*., 2004. Minimally invasive unicompartmental knee replacement with a nonimage-based navigation system. Int. Orthop., 28: 193-197.

Schulz, A.P. and S. Fuchs *et al*., 2006. Navigated Knee Arthroplasty for Posttraumatic Arthrosis-Early Results. Eur. J. Trauma, 32: 137.

Schulz, A.P. and S. Maegerlein *et al*., 2007. Results of computer assisted total knee arthroplasty-A Trauma Surgeon Experience. CAOS UK Annual Conference, London.

Schulz, A.P. and U.J. Gerlach *et al*., 2005. Septic arthritis after tibial head fracture-can knee functionality be salvaged? Injury, 36: 467.

Stindel, E., and J.L. Briard *et al*., 2002. Bone morphing: 3D morphological data for total knee arthroplasty. Comput. Aided. Surg., 7: 156-68.

Weinrauch, P., N. Myers *et al*., 2006. Comparison of early postoperative rehabilitation outcome following total knee arthroplasty using different surgical approaches and instrumentation. J. Orthop. Surg. (Hong Kong), 14: 47-52.

Weiss, N.G., and J. Parvizi *et al*., 2003. Total knee arthroplasty in patients with a prior fracture of the tibial plateau. J. Bone Joint Surg. Am., 85-A: 218-21.

Wu, L.D. and Y. Xiong *et al*., 2005. Total knee replacement for posttraumatic degenerative arthritis of the knee. Chin. J. Traumatol., 8: 195-9.

Zorman, D., and P. Etuin *et al*., 2005. Computer-assisted total knee arthroplasty: Comparative results in a preliminary series of 72 cases. Acta Orthop. Belg., 71: 696-702.