

REPORT

Robotic Travelling Fellowship 2023

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Fellowship report

Report by:	Max Thieme
Date of the fellowship:	19.02.2023 -17.03.2023
Visited institutions:	<p>19.02.2023 -26.02.2023 Orthopaedic Clinic of Medical School Hannover, DIAKOVERE Annastift - Prof. Dr. Henning Windhagen</p> <p>26.02.2023-04.03.2023 University Clinic Brandenburg an der Havel Prof. Dr. Roland Becker</p> <p>04.03.2023-12.03.2023 Graz/Kalwang, AUVA UKH Styria (Steiermark) PD Dr. Antonio Klasan</p> <p>12.03.2023-17.03.2023 Kepler University Clinic Linz Dr. Philipp Proier</p>

I was honoured to be accepted as a fellow of the EFORT Robotic Fellowship supported by Stryker. I had the unique opportunity to visit two clinics in Germany and two clinics in Austria where robot-assisted arthroplasty is performed. It was interesting to get to know the different working methods of the clinics and the differences in the working steps.



This fellowship also served as a scientific exchange and opened other scientific perspectives for future research projects at my own clinic. I am grateful to have travelled with Dr. Luger from Linz who has always been a good companion and discussion partner. In the pictures, he is the one of us without glasses.



Hanover

My first week began with a visit to the Department of Endoprosthesis at the Orthopaedic University Hospital Hanover.

On the first day in the morning, I was warmly welcomed by the head of the department, Prof. Dr. Windhagen, in his office. Then it was off to the morning meeting, where the weekend's cases were discussed.

Afterward, it was straight to the operating theatre with the senior physician PD. Dr. Ahmad. He oversaw us fellows and it was a pleasure to have a scientific discourse with him - and there were a few during the week.



No robot-assisted operations were planned for this day. So, I had time to get to know the arthroplasty team better and took part in two periacetabular osteotomies according to Ganz for the treatment of hip dysplasia with PD. Dr. Ahmad. These were performed extremely routinely and with impressive speed.

During the week, nine periacetabular osteotomies according to Ganz were on the surgical schedule, which was an impressive number. Two total hip replacements were also on the same day's schedule.

In the evening, I met for dinner with Prof. Dr. Windhagen and his team. The different philosophies of an orthopaedic clinic were discussed and Prof. Dr. Windhagen made it clear that Hanover wants to be a pioneer in new systems and technologies ("Makomania in Hanover") and therefore two robotic systems are in use for endoprosthesis (Mako from Stryker and CORI from Smith & Nephew). In addition, they want to have a wide range of prosthesis systems in order to be able to care for patients individually. In Hanover, kinematic alignment is a practised philosophy that is carried out with the robot with the highest precision.

On the second day, it was hands-on. I had the opportunity to participate in and perform total knee arthroplasty procedures under supervision. Two robot-assisted prostheses were on the agenda. In the first operation, a retropatellar replacement was also performed. Prof. Dr. Windhagen explained to me how important it was for the patella to run correctly and that the concept of kinematic alignment was used to create the cutting plans. Here, the Mako robot is clearly superior to other systems with its precision and various adjustment possibilities.

The advantages of robot-assisted arthroplasty are obvious. It is easy to implant unicompartmental prosthesis and to insert a femoropatellar replacement with a precise fit. Here, the machine is clearly superior to manual implantation in terms of precision. In addition, cementless implantations are possible more and more often because the accuracy of the cuts and milling allows it.





On the same day, we were also able to see the Smith and Nephew system in use. This is a CT-free system that creates a 3D model intraoperatively by tracing the anatomical structures. Unlike the Mako from Stryker, the cuts are not made by a guided saw but by a milling machine. If all the steps are milled, this proves to be a lengthy process, which is why in Hanover, the decision was made to mill the first cuts and then to apply the cutting blocks.

On the third day, two more Mako operations with total knee replacement took place. The MPS explained to me what work he does on the plans in advance. It also became clear that every system has its limits. If the matching with the CT is not done properly with the MAKO, there are inaccuracies in the execution of the saw cuts. In addition, changing the position of the tibial or femoral marker can lead to inaccuracies.

After these surgeries, I was also allowed to assist in a hip cup revision with cup replacement. Modern implants with tetrapod structures were used for better bony integration.

In the evening, a scientific exchange took place in the form of a journal club, where we, as fellows, each presented an article from our clinical research. The topics were periprosthetic fractures in short-shaft hip prostheses and impingement in non-optimal cup positioning.

The Hanoverian team presented studies on the superiority of kinematic alignment, which were carried out in an interdisciplinary way with the biomechanics from Hanover.

On the fourth day, I was allowed to stand at the operating table again and observe the implantation of two knee TEPs at close range. It became apparent that the non-standardised ligament tension test can lead to inaccuracies that make implantation more difficult. It is therefore worth investing a little more time in this step, as it usually pays off in the course of the operation. Other highlights of orthopaedics with a surgical hip dislocation after unsuccessful arthroscopic impingement removal for femoroacetabular impingement and open arthroplasty were also on the programme.

In the evening, we met up with some of the assistants and PD. Dr. Ahmad to eat burgers together. Anecdotes from the daily routine in the clinic were shared.

On the fifth day, the first Mako hip was on the programme. Here it became clear that you must fully trust the technique, because there is no real feeling of pressure when milling the cup. In Hanover, the approach was changed to the anterior approach in order to position the markers better and remove them more easily. Nevertheless, the cup had to be well exposed in order to be able to match it well with the CT. The cup was then inserted with a robot. The exact positioning of the cup is probably the biggest advantage here, dislocation or impingement can be safely prevented with correct alignment. The stem was not inserted with the help of the robot.

As the Fellowship progressed, it became apparent that this was not being done in any clinic. On the same day we saw another Ganz periacetabular osteotomy and an arthroscopy of the hip with arthroscopic CAM ablation. In the evening we met with PD. Dr. Ahmad and had a long professional discussion over Italian food about the different





procedures for implanting hip and knee endoprostheses in our home clinics and the clinic in Hanover.

On the sixth day, there were no more robot points on the programme, so we fellows visited Hanover. This included the Herrenhäuser Gardens and the Berggarten, which are definitely worth a visit.

In the evening, I met up with the medical team, first for dinner at a Japanese restaurant and then to go go-karting together. Everyone was committed and did their best. Fortunately, no one was seriously injured. Afterwards, I was given a warm farewell and it was decided to keep in touch.

Day seven was a travel day. I took the train from Hanover to Brandenburg, where I arrived in the afternoon thanks to the excellent planning of Mrs Marchal from EFORT.

In summary, I would like to thank Prof. Dr. Windhagen's highly professional and scientifically excellent team for a great and very educational time.

Brandenburg an der Havel



On my first day in Brandenburg, I was warmly welcomed by the head of the orthopaedic and trauma surgery department, Prof. Dr. Becker, and senior physician Dr. Salzmann.

In contrast to the orthopaedic clinic in Hanover, orthopaedics and trauma surgery were merged in Brandenburg an der Havel years ago. The department is focused on trauma surgery but also supplying state of the art endoprosthetics.

Here, too, robot-assisted operations were not yet on the agenda for the first day. First, I saw an anterior cruciate ligament

replacement combined with Lemaire procedure. I also saw the implantation of two hip prostheses. A tibia nail for a pseudarthrotic lower leg fracture was also on the schedule. In the evening, we fellows had dinner together and had lively discussions about the pros and cons of merging orthopaedic and trauma surgery clinics.

On the second day, two MAKOS were on the agenda. One was a femoropatellar replacement. It only remains to mention how superior the robot-assisted milling is to any manual surgical method. I also saw the implantation of a total knee endoprosthesis. Here Prof. Becker used a ligament tensioner in order to be able to carry out reproducible standardised measurements. In addition, the patella run was carried out by marking the trochlea preoperatively and superimposing it with the planning in order to ensure an optimal patella run.



On day three, two unicondylar prostheses were implanted using the robot and the reamer attached to it. Similar to the femoropatellar replacement, the accuracy of the implant fit was outstanding. The MPS also explained to me the advantages of the hip prosthesis. For example, the pelvic tilt in the standing position can be taken into account when planning the cup position and bony impingement is almost impossible.

During the morning of the fourth day, I saw two MAKO-assisted total knee arthroplasties. Unlike in Hanover, the implantation was usually cemented.

In the afternoon, we fellows visited the city's cathedral. In the evening we met Prof. Dr. Becker and Dr. Salzmann for dinner. We talked about the difficulty of merging a trauma surgery and orthopaedic clinic and about the different trainings of orthopaedic surgeons and trauma surgeons in various European countries. Prof. Dr. Becker also explained how the University Hospital Brandenburg an der Havel was established.

On day five, a cultural programme was on the agenda. I drove to Potsdam to visit the Villa Berberini. Prof. Dr. Becker had recommended it the day before. The palace gardens of Sanssouci were also worth the visit. From Potsdam, I made a short trip to Berlin for currywurst and sightseeing.

Day six was again a travel day during which I flew from the main airport in Berlin to Graz.

In summary, I would like to thank Prof. Becker and his team for their hospitality. This second station allowed further deep insights into robotics. A recurring theme was the objectivity of the ligament tension measurement. According to Stryker, this should be measurable over the entire movement sequence during the next software update.



Graz/ Kalwang



On the seventh day of the second week, Dr. Luger and I visited Graz. Since he had studied in Graz, he knew every sight here and proved to be an excellent guide.

The third stop was in Graz and Kalwan where I met PD. Dr. Klasan at the AUVA hospital in Graz in the morning of the first day.

On this day there were no robotics operations in Kalwang. First, I went to the early morning meeting where I got to see the large team of the department for the first time. In the operating room, the first

point was a total knee replacement. This was followed by the removal of an unstable Osgood-



Schlatter finding. Then, a plate inserted from the dorsal aspect of the knee was removed via a popliteal approach. Adhesions in the access area proved to be a challenge.

On the second day, we travelled with PD. Dr. Klasan to the AUVA clinic in Kalwang. Probably the smallest place in the world (about 900 inhabitants) with a MAKO robot. Here, PD. Dr. Klasan proved that robotics is also possible at impressive speed. The implantation of a total knee endoprosthesis took only 39 minutes.

He also performed a MAKO unicondylar prosthesis implantation with cruciate ligament replacement using an Achilles tendon donor graft.

In the evening we met for dinner with Prim. Prof. Dr. Kammerlander the medical director of Graz and Kalwang. During the meal, we had a phenomenal view over Graz. The differences between the healthcare systems in Germany and Austria were discussed.

On the third day, we were back in Kalwang. Two Mako knee total endoprosthesis operations were on the agenda. PD Dr. Klasan explained his concept of always correcting valgus completely and performing mechanical alignment and treating varus in terms of kinematic alignment.

On the fourth day in Kalwang, a prosthesis was implanted with severe varus. The limit of what is possible with a normal prosthesis was pushed by the robot, and there is still a safety of the implantation. In addition, a unicondylar prosthesis was combined with a femoropatellar replacement as well as a retropatellar replacement. I had not seen anything like that up to that point.



On the fifth day, there was no more orthopedic surgery, so we visited Graz on foot and had an appointment with PD. Dr. Klasan for bowling in the evening. Here, he showed his sporting power and outclassed us. In further discussions, it became apparent that there are major differences in the financing and staffing of Austrian and German hospitals. The cost pressure in Germany is much greater.

On the sixth day, sightseeing in Graz was on the agenda. We visited the most important sights of Graz on foot. In the meantime, we discussed the various medical device manufacturers and the advantages and disadvantages of the different systems.

Day seven was again a travel day. We took the train from Graz to Linz.

In summary, I would like to thank PD. Dr. Klasan for his tireless commitment to introducing us to robot-assisted arthroplasty.



Linz

The last stop of the travelling fellowship was at the University Hospital in Linz. Here, too, the orthopedic and trauma surgery departments have been combined.

On the first day, I was welcomed by senior physician Dr. Proier and head physician Prof. Dr. Gotterbarm after the early morning meeting. A short time later, I was already in the operating room where I was allowed to assist the senior physician Dr. Schopper with two total hip replacements. After that, Dr. Luger, who is from Linz, was allowed to implant a duo head prosthesis.

The following day, I had a lively discussion with Dr. Proier about the measurement inaccuracies of planning software on the computer and discussed with him the cases of the next days. He pointed out that the markers set by the MPS in the CT are of great importance to obtain accurate values in the end. Two total knee arthroplasties were implanted that day. The workflow was only slightly different from that in Graz, which was not surprising since PD. Dr. Klasan from Graz had previously worked in Linz. In addition, a unicondylar prostheses was implanted.



In the evening, I met Prof. Dr. Gotterbarm and Dr. Proier for dinner. They discussed the fact that more and more unicondylar prosthesis are being implanted in Linz. This is certainly also an effect of the increasingly safe implantation thanks to the MAKO robot.

On the third day, two more unicondylar prosthesis were implanted. One of them was a lateral unicondylar prosthesis.

On the last day, another MAKO assisted hip prosthesis was performed. The cup milling and positioning went well.

Afterwards, I said goodbye to the team around Prof. Dr. Gotterbarm and started my return journey to Regensburg the next day.

In summary, I would like to thank above all Dr. Proier, who enriched the stay with his detailed discussions of the cases and his profound knowledge.



Conclusion

My technical skills have been enhanced during the fellowship, I learned to understand the different setting options of the MAKO robot and what opportunities robotics offers. I also saw the importance of preoperative planning on CT or X-ray for hip and knee arthroplasty. I also acquired theoretical knowledge during the fellowship. I learned about the different theories of alignment. The mechanical and kinematic theories are the most important. However, it should also be noticed that the distinction between the different forms of alignment is not always given.

In addition, by comparing the Mako with the Cori, I saw the differences between a CT-based system and an intraoperatively created 3D model and where the strengths and weaknesses of the individual systems are.

My goal is to incorporate the kinematic alignment more into the planning of surgeries in my own practice. Even though the benefits such as a better patient satisfaction and improved mobility and pain reduction are small compared to mechanical alignment, but the long-term results are expected to be beneficial to the patient.

How the fellowship has contributed to my professional development is still difficult to answer even three weeks after the fellowship. The fellowship has shown me how important robotics is in orthopedics and will be in the future. In all likelihood, robotic systems will occupy an ever-larger space.

In addition, networking took place during the fellowship. Contacts to four clinics in Germany and Austria were established and will certainly be maintained in the future. Perhaps joint research projects will arise in the future.

My plans for the future are to continue research in the field of endoprosthetics and to dive even deeper into the subject. In this regard, there were many suggestions for future research projects that were already started during the fellowship.

To come to a conclusion, I have to admit Robotics has established itself. Robotics has its justification. Robotics will improve the safety of care in the future. I can recommend this scholarship to everyone to broaden horizons and open eyes. Or as Dr. Proier put it: At first, arthroplasty seems simple until you really get into it and think about the basics. This is probably what distinguishes a good surgeon from a bad. The goal is to understand how to use his "Robotic tool" to achieve the best individual result for the patient.

In the end, I want to thank EFORT for this opportunity.

Max Thieme

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