

## RESEARCH NEWS

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### Artificial hip joints

#### Precise adjustment in the operating room

**After a patient has been fitted with an artificial hip joint, sometimes the leg on that side ends up longer or shorter than before. This can lead to problems in the spinal column. A newly developed procedure enables leg length to be precisely adjusted during hip replacement surgery.**

Today hip replacement is a routine surgical procedure. Some 210,000 hip prostheses are implanted every year in Germany. A frequent complication consists of the situation that, after the operation, the patient's leg is not the same length as it was before. Normally, a leg length discrepancy of less than one centimeter is well tolerated. Any more, and the patient will most likely have to wear orthopaedical shoe lifts to compensate for postural imbalance and prevent back pain.

Fraunhofer Institute for Machine Tools and Forming Technology IWU, together with partners in science and industry, has found a solution to this problem. "It consists of three main components: an optical system to measure leg length, a modular implant design, and a pre-op planning software tool," says Dr. Ronny Grunert from the institute's Department for Medical Engineering.

The leg length is measured in the operating room just prior to surgery. First, a plastic box with optical markers on its surface is attached to the patient's tibia. Holding the limb in extension, the surgeon then takes the leg by the heel and lifts it upward. During this maneuver, a 3D camera is used to record the circular motion described by the optical markers on the patient's shin. In essence, it's like using a mathematical compass to draw circles around a point, which in this case is the hip joint around which the leg rotates. In this analogy, the optical markers correspond to the tip of the pencil. After provisionally inserting the implant, a second measurement is carried out. The software program compares the two rotational measurements to verify that the leg length remains the same before and after the intervention. If a difference is detected, the length inequality must be corrected.

#### Free choice of femoral stem and acetabular cup

"Together with our partners, we have developed a modular concept that allows the size and position of the artificial hip joint to be optimized for each patient during surgery," explains Grunert. This modular approach is more flexible than having to choose between prefabricated implants in a limited range of sizes. It allows the surgeon

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#### Contact

**Janis Eitner** | Fraunhofer-Gesellschaft, Munich | Communications | Phone +49 89 1205-1333 | [presse@zv.fraunhofer.de](mailto:presse@zv.fraunhofer.de)

**Martin Lamß** | Fraunhofer Institute for Machine Tools and Forming Technology IWU | Phone +49 371 5397-1454 | [martin.lamss@iwu.fraunhofer.de](mailto:martin.lamss@iwu.fraunhofer.de)  
Reichenhainer Strasse 88 | 09126 Chemnitz | [www.iwu.fraunhofer.de](http://www.iwu.fraunhofer.de)

to select the best-fitting combination of femoral stem and acetabular cup. The procedure consists of implanting the femoral stem and connecting it with the acetabular cup by means of a sliding screw. By adjusting the position of the screw, it is possible to precisely adjust the leg length according to the pre-op measurement. If necessary, a different acetabular cup can be selected.

The third component of the new procedure, the pre-op planning software, helps the physician to select the most suitable prosthetic joint. Dr. Torsten Prietzel, Medical Director of the Endoprosthesis Network and Chief Surgeon at the Helios Clinic in Blankenhain, is already using the software on a trial basis. The modular implants and the system for measuring leg length are also still in the test phase. Ronny Grunert estimates that all three components of the system will be ready for clinical use in two years' time.

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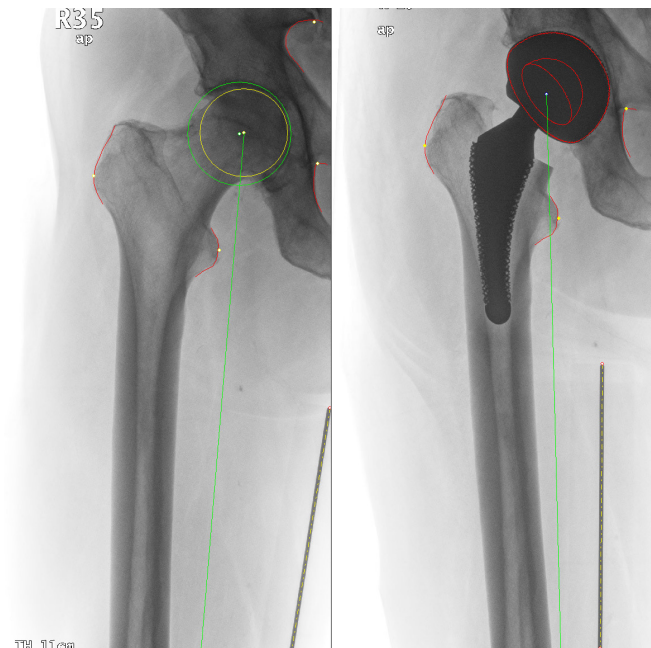
**Endoprosthesis Network**

The Endoprosthesis Network was created in 2013 with the aim of developing next-generation artificial joints. During the SME innovation day held by the German Federal Ministry for Economic Affairs and Energy on June 7, 2018, it was labeled the network project of the year. The nationwide network is coordinated by Fraunhofer IWU. Its members comprise ten industrial companies and eight research institutions which together cover the entire endoprosthesis value chain. The following partners participated in the development of the new procedure consisting of measurement of leg length, modular implant and pre-op planning software: MSB-Orthopädie-Technik GmbH Leipzig; AQ Implants GmbH; Leipzig University Faculty of Medicine; University of Applied Sciences Zwickau, Faculty of Physical Engineering/Computer Sciences; Forschungs- und Transferzentrum e.V. at the University of Applied Sciences Zwickau; and ISD – Internet Systems GmbH Dresden.

Further information:  
[www.kunstgelenk.eu](http://www.kunstgelenk.eu)



The modular hip implant allows the femoral stem and acetabular cup to be adapted to each individual patient. © Fraunhofer IWU | Picture in color and printing quality: [www.fraunhofer.de/en/press](http://www.fraunhofer.de/en/press)



The pre-op planning software enables the surgeon to select the ideal implant and define its position. © Fraunhofer IWU | Picture in color and printing quality: [www.fraunhofer.de/en/press](http://www.fraunhofer.de/en/press)