Your individualized knee prosthesis

Patient Information Brochure







Introduction

Established in 1989 and based in Yverdon-les-Bains, Switzerland, Symbios Orthopédie S.A. [hereinafter Symbios] specialises in individualized orthopaedic hip and knee implants. Symbios has been developing innovative technology for the 3D design of implants from the outset, tailored to individual patient needs. With 30 years of experience in the design and manufacture of individualized implants, Symbios is the European leader in this field.

Total knee replacement is a common procedure in cases of severe knee-joint degeneration. Despite this, many studies report up to 30% dissatisfaction among patients with total knee prostheses^{(1), (2), (3)}. One reason for this is that individuals are anatomically different, while cartilage degeneration caused by osteoarthritis makes optimising implant placement complex. Furthermore, because the average shape of standard prostheses does not accommodate all potential morphological variations, compromises are often made between the original shape of the bone and that of the implant.

Symbios uses proprietary technology to design and produce individualized knee prostheses that reproduce the best match of each patient's anatomy, with the aim of improving patient satisfaction and mobility.

What is osteoarthritis?

Healthy knee anatomy

The knee is the joint connecting the leg to the thigh. It is made up of three bones: the **femur**, the **tibia** and the **patella** (or kneecap). In a healthy knee, the bones are covered with **articular cartilage**. This protects the bone and facilitates sliding between the joint surfaces when the knee is flexed. Cartilage gets worn down both over time and with use.

The femur and tibia are connected by **ligaments**, their role is to **stabilise the joint**. The four main ligaments in the knee are the anterior and posterior **cruciate ligaments**, and the medial and lateral **collateral ligaments**. Very powerful **muscles** move the joint (during walking, sports, etc.) and help to support it. These muscles are connected to the bones by **tendons**. **Menisci** are small fibrocartilage pads that act as shock absorbers and cushion the contact between the femur and the tibia.



Worn cartilage

Knee osteoarthritis (or gonarthrosis)

Osteoarthritis is a condition characterised by degenerative and chronic wear and tear of the articular cartilage. Osteoarthritis is the most common joint disease and the first symptoms generally appear from the age of 40-50. It may occur earlier, especially following trauma (e.g. fracture, ligament injury or meniscus tear).

In knee osteoarthritis, the cartilage of one or more bones in the joint gradually wears out and eventually disappears. This degeneration leads to **direct contact between the bone surfaces** beneath the cartilage, causing **acute mechanical pain**. Such pain makes it difficult to move the knee, as well as to sleep, and gradually contributes to a very significant deterioration in the patient's quality of life.



Damaged cruciate ligament

What is a knee prosthesis?

Total knee replacement

Total knee replacement, or total knee arthroplasty, is one of the most common surgical treatments for gonarthrosis, once medication (anti-inflammatories, infiltrations) no longer has sufficient effect. Prescription and implantation of a knee prosthesis are carried out by an orthopedic surgeon. When carried out successfully, the implantation eliminates the pain associated with osteoarthritis and significantly improves knee mobility.

Total knee arthroplasty aims to replace any bone and cartilage worn out by osteoarthritis through the insertion of a prosthesis.

The knee prosthesis is made up of three or four metal and plastic components.

- The **femoral component** [metal] and the **tibial component** [metal] replace the articular surfaces of the femur and tibia worn down by osteoarthritis.
- The **polyethylene tibial insert** (plastic) replaces the cartilage by allowing the metal prosthetic components to articulate with each other. In addition, the insert also allows total or partial replacement of cruciate ligaments by increasing stability between the femur and tibia.
- The **patella component** (plastic) serves as a substitute for the worn cartilage of the patella. Patella replacement is not always required when fitting a prosthesis.



The components of a total knee prosthesis are made from biocompatible materials and must comply with the tests and requirements demanded by the standards in place.



What are the possible alternatives for your prosthesis?

Standard prostheses

- Common and average prosthesis shape
- Range consisting of standard sizes
- Manually adjustable instruments

Implant sizes never completely match the individual anatomy of each patient. The surgeon has to choose the best combination of size, position and alignment for the prosthesis.

Individualized ORIGIN® prosthesis

- 3D-modelling of the patient's knee
- Individualized prosthesis
- Individualized single-use instruments

After modelling your knee in 3D using a CT scanner, Symbios then designs and manufactures **an individualized prosthesis specifically for you.**





The ORIGIN® prosthesis is designed to restore your knee to its preosteoarthritic condition, allowing you to regain your mobility and return to a normal life.

Why choose an individualized prosthesis?

Your knee is unique

The anatomy of the knee is complex and varies greatly from one individual to another. There are many variations in bone shape that can depend on size, gender, physical activity and ethnicity. This makes your knee unique and unlike any other.





Reproducing your knee to restore natural function

Several scientific studies show that the alignment of the leg and the shape of the bones are related to its function. This is a consequence of the evolution of each individual's function and mobility from birth. When fitting a knee prosthesis, it is therefore essential to be able to restore the very specific shape of the knee, in order to be able to regain function and mobility that are as natural as possible.



Standard prosthesis ranges come in many sizes, but have a common shape that corresponds to the anatomical average. They do not adapt to the individual anatomy of each patient. This may mean that the surgeon has to adapt the patient's ligaments to the prosthesis to ensure joint stability. Quite often, the surgeon must also accept compromises in terms of the prosthesis' shape that may increase the risk of postoperative pain or limit the patient's mobility. In contrast, the individualized ORIGIN® prosthesis accurately reproduces the shape and contour of your knee. The alignment of your leg is also restored to its condition prior to the wear and tear of your joint cartilage. The prosthesis adapts to you and not the other way around.

The prosthesis adapts to your knee, not the other way around.

Standard knee prosthesis



Individualized knee prosthesis



How is your individualized prosthesis made?

Scan of your knee

The first step is for your surgeon to prescribe a scan to be performed at an approved radiology centre, in order for the Symbios scan protocol to be carried out. This examination will provide images of your damaged knee. Your surgeon will send them to Symbios who will then start designing your prosthesis.





3D analysis of your knee and designing your ORIGIN® prosthesis

Using the scan images provided by your surgeon, Symbios specialist, based in Switzerland, can reconstruct the 3D anatomy of your knee. Drawing on 30 years of expertise in the design of individualized prostheses, Symbios specialist analyse your knee in 3D and design a prosthesis that is perfectly adapted to your individual anatomy.

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Approval by your surgeon

Your surgeon will receive the 3D plan and design proposal for your individualized prosthesis, so that he or she can check its dimensions and technical specifications. Once the design is approved by your surgeon, Symbios begins the manufacturing of your prosthesis.

Manufacture of your ORIGIN® prosthesis and individualized instruments

Manufacturing your individualized ORIGIN® prosthesis is a complex process that will take several weeks to complete. The components of your prosthesis are machined using metal or polyethylene preforms. Individualized single-use instruments are manufactured using 3D printers (or "additive manufacturing"). The products are subjected to various surface treatments, such as sanding or polishing, and are then cleaned, decontaminated, packaged and sterilised.



5 Delivery of the ORIGIN® pack to the hospital

Once all the implants and individualized instruments are manufactured and sterile, they are assembled in the ORIGIN® box, which contains all the components needed to fit your prosthesis. Everything is then sent by courier to the hospital in readiness for your operation.





Prepare for your operation

Preoperative medical check-up

Before the operation, your doctor will prescribe a medical check-up to assess your overall health and to make sure there are no risk factors that could interfere with the surgery. It is recommended that you provide your surgeon with a complete list of all medications you are currently taking. It is also **strongly adviseable to perform a preoperative dental check-up** to prevent the risk of infection originating in the teeth and mouth, which can be a source of postoperative infection.

Preparing for your return home and home care

Before the operation, make sure you have all the assistance you need when you return home. During the first few weeks, having support for everyday tasks such as washing, cooking, housework, shopping, etc. will be very useful. **Do you have someone who can help you, such as a spouse, companion, carer, friend or family member?** If you do not have a home support network, you may want to consider going to a rehabilitation facility or care home while you recover.

On the day of the operation

Your doctor will ask you not to eat or drink anything for a certain period of time before your operation. Don't forget to bring all your usual medication, even that which you had to stop taking before the operation.

The anaesthetist and the surgeon will provide individual release forms for you to sign. A risk information and consent document will also be provided to you to review and sign. The intake nurse will take you to your room and familiarise you with the hospital environment. Your blood pressure and heart rate will be monitored. The anaesthetist will examine you and recommend a suitable anaesthetic procedure. Once the anaesthetic has taken effect, your knee will be scrubbed, shaved and sterilised. **Surgery will take approximately 1 to 2 hours.** After the operation, you will be taken to the recovery room. You can expect to feel some pain immediately after surgery, but specific care is provided to alleviate it. Feel free to call the nursing staff, even in the middle of the night, to ask for pain relief.

After the operation

Your knee may remain swollen and tender for several days after the operation. Recovery rates vary from patient to patient and also depend on the medical team's approach. You will be supported throughout all the stages of the rehabilitation process. Some of the rehabilitation will take place in the hospital and the rest at home. It is important to follow the instructions provided by your physiotherapists to help you regain your mobility.

The average hospital stay lasts one to four days, depending on patient recovery. When returning home, it is very important to follow the instructions provided by your surgeon, physiotherapists and care teams. You will probably be more tired than usual. You should keep an eye out for any abnormal signs or symptoms. Be sure to call your doctor if you experience severe pain or persistent fever, redness or swelling of the knee, nausea or vomiting.

Your follow-up visits should be performed by the surgeon who performed the procedure or by an experienced PSI (Patient-Specific Implants) surgeon to avoid any misinterpretation of the clinical and radiological examination.



Do your best for your new knee

Returning to your regular routine

Upon returning home, you should stay active, but be careful not to do too much, too soon. Build up your levels of activity gradually, following the instructions provided by your surgeon and physiotherapists.

Taking care of your knee over time

In order to maximise the life span of your new knee, make sure you follow the instructions given to you by your surgeon and respect these simple rules to avoid potential complications:

- Maintain a healthy weight
- Stay active and healthy
- Avoid excessive physical activity
- Go for regular health check-ups

And above all...

Enjoy life with your new knee!

References

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