Meniscus

General Information

The human knee joint has an internal and external meniscus. Each meniscus consists of elastic collagenous fiber tissue. Both menisci lie between the sliding surfaces of thigh and lower leg. When flexing or stretching the knee, they move along into the same direction, just as they do with inner- and outer rotating movements. The external meniscus is smaller and more flexible than the internal meniscus. Menisci serve as balance of the incongruence between the thigh and the lower leg and as extension of the supporting surface and power transmission. When transmitting power, menisci effect a stress distribution of 30-70 % of total load (after removal of the complete meniscus stress on the cartilage increases). Furthermore, the meniscus is responsible for shock absorption and joint lubrication, and also increases stability of the entire knee joint. Meniscus ruptures can have a traumatic or degenerative reason, and they occur three times as often on the inner side as on the outer side of the knee joint.

Fig. 1:
Top view inner- (medial) and outer (lateral) meniscus (source: Smith & Nephew GmbH)

Often, the trauma of a twisted knee results in a meniscus injury.
However, in most cases it is the degenerative meniscus damage which occurs due to the early aging process of the meniscus tissue without having an adequate trauma. This is mostly the result of overload and/or axial malposition, or the result of repeated microtraumas.
Meniscus

Medical Conditions

The most common symptoms of meniscus damages are pain in the outer- or inner side of the knee joint, especially under stress and specific rotational movements. A “block” in the joint i.e. temporary inability to flex or stretch the knee is a specific indication for a basket handle- or lap tear. Another indication can be swelling or hyperthermia of the knee joint due to the acute irritation.

Therapy

Therapy of meniscus damages can, depending on the degree of severity, be carried out conservatively or surgically. When having a stable meniscus rupture which is relatively free of symptoms and stands physical stresses of everyday life, treatment can be made with combined medical-physical therapy.

Operative therapy is made with a minimally invasive and arthroscopic technique. Because of known long-term consequences, therapists always try to retain as much meniscus tissue as possible with young patients. When having a basket handle or lap tear of the meniscus, in some cases even stitching up the rupture is enough. When these ruptures lie within the central area of the meniscus which is well supplied with blood, there are good chances of recovery. The chance of this kind of therapy being successful has to be decided by the experienced surgeon during surgery.

Fig. 2: Complex rupture after partial meniscectomy
Fig. 3: Complex rupture without any suture option
Fig. 4: Bucket handle tear
Fig. 5: Meniscus suture
Meniscus

Meniscus Suture

In our ARCUS Clinics different suturing techniques are used, depending on the need. All of them are well-proven, and show few complications and good chances of recovery. In order to accelerate wound healing of the torn part of the meniscus and induce ingrowth of blood vessels, fissures are previously prepared by “needling” and “rasping” them with microsurgical instruments. When having a small fissure only or a cruciate ligament rupture at the same time, this often is completely sufficient and is seen as indirect suture technique. When having an isolated meniscus injury or a bigger fissure, however, a direct meniscus suture is necessary and carried out by stitching up the fissure.

Partial Meniscectomy

If it turns out that stitching up the meniscus is not possible, partial meniscectomy is being carried out. Here, as much as necessary but as little meniscal tissue as possible is being removed to keep the remaining meniscus stable and functional. Due to this partial removal of the meniscus the supporting surface becomes smaller, but (of course depending on the amount of tissue removed) this normally has no negative effect on joint functions.

Aftercare

After surgery, you are not allowed to drive yourself. In most cases we prescribe an anti-inflammatory medication which has to be taken regularly. Furthermore, prophylaxis of thrombosis and embolism by an abdominal injection is essential as long as walking on crutches. A drainage positioned into the knee joint normally is removed after one or two days, suture material after 10-12 days. This process is being carried out by the referring specialist or family doctor.

Having had a meniscus suture, the knee should not be bent under stress for more than 90 degrees within the first 12 weeks (do not squat!). During the first 2 weeks, the only pressure the knee shall be load with is sole contact. The 3rd and 4th week, load can amount to 20 kg and afterwards the patient can start with moderate muscle training. In most cases, start of intensive sporting activities is possible after 3-4 months.

After partial meniscectomy it is not allowed to put full weight on the leg for about 5-7 days. Moreover, as long as walking on crutches, adequate prophylaxis of thrombosis and embolism is necessary.
Meniscus Replacement

When a large portion or even the complete meniscus had to be removed with a young patient, meniscus transplantation or meniscus replacement should be discussed as a lacking meniscus may very early lead to diseases such as arthritis. The treatment can delay beginning arthrosis and its success is closely connected with existence of health cartilage tissue, intact ligaments and the physiological axis of the leg.

Transplantation of a donor meniscus (“allograft”) is possible as well as implantation of artificial meniscus replacement tissue (“CMI” = collagen meniscus implant or “ACTIFIT” = polyurethane meniscus implant). Implants are operatively tailored to fit perfectly into the prepared defect. Then, the chosen implant is being sutured and has to heal for several weeks. The new tissue shall restore normal functions of the meniscus, relieve pain and even stop the degenerative process. Due to very strict indications, however, this surgery is being carried out rather rare.

Fig. 6:
Meniscus replacement (source: ReGen Biologics)

Aftercare

After meniscus replacement surgery, walking on crutches for 2-3 months is necessary to support the healing process of the donor meniscus.
Anterior Cruciate Ligament (ACL)

General Information

Cruciate ligament injuries are often the result of acute accident- or sports injuries. When having injured the cruciate ligament, the knee joint swells up due to the hematoma. More symptoms are painful limitation of knee movability and, depending on the severity of injury, the feeling of instability on the affected leg. In this acute condition, diagnosis may be very difficult as pain, swelling and tense muscles hinder medical examination. A positive result of the pivot-shift test is seen as reliable sign for an anterior cruciate ligament rupture; a positive Lachman provides the best likelihood ratio.

Besides the orthopedic examination, magnetic resonance imaging (MRI) is recommendable with new cruciate ligament injuries as a high percentage of patients also have concomitant injuries such as meniscus-, medial collateral ligament-, and cartilage damages. With the magnetic resonance imaging the entire extent of the injury can be detected. Therefore, MRI has special relevance with regard to surgery planning as well as for allocation of concomitant injuries to be operated (e.g. menisci, lateral ligaments and/or the dorsolateral capsule edge with rupture of the Popliteus tendon).

Fig. 1:
Knee joint with cruciate ligaments and menisci (source: Smith & Nephew GmbH)

Difficulties with Cruciate Ligament Ruptures

Our cruciate ligaments form the central stabilizing column of the knee joint (fig. 1). Their principle purpose is to prevent the knee joint against abrupt stopping- and accelerating movements as well as rotational movements. Injuries of cruciate ligaments occur in more than 90 % of all cases to the anterior cruciate ligament (ACL). The cruciate ligament rupture causes serious impact on natural movements of the joints. Although with muscular and trained athletes a cruciate ligament rupture
Anterior Cruciate Ligament (ACL)

can be compensated in the beginning with conservative therapy, damage of further structures and with this a considerably higher risk of arthrosis has to be expected.

After having had a cruciate ligament rupture, most patients focus on regaining their condition first. Need for surgery depends on activity, symptoms of instability and age, and especially the athletic patient benefits from prompt operative treatment. Conservative treatment, however, is also completely justified with low instability symptoms and low physical activity. With cruciate ligament injuries in childhood and adolescence, operative reconstruction by the use of appropriate techniques should be considered to prevent serious consequential injuries such as damages of secondary joint cartilages or menisci. We have just published comprehensive experiences and numerous studies regarding this issue.

Current Surgical Techniques

Thanks to the enormous development of arthroscopic surgical techniques, treatment options for cruciate ligament replacements have improved considerably over recent years. Shorter operation times and a reduced surgical trauma, less pain and better cosmetic results speak for today’s minimally invasive operation methods. Correct surgical treatment, however, needs maximum experience (fig. 2+3) and therefore should be carried out in specialized centers. In the ARCUS Clinics in Pforzheim more than 1200 arthroscopic cruciate ligament surgeries are carried out every year. Arthroscopic cruciate ligament replacement using autologous tendon transplants has reached standard level by now. Used are hamstring tendon transplants (semitendinosus- and gracilis tendon) in triple- and quadruple binding technique as well as patellar tendon strips, quadriceps tendons and after multiple ruptures also donor grafts. Common characteristics of all these transplants are their tear resistance and flexibility which are similar to the anterior cruciate ligament. But they differ regarding the removal technique and their anchoring possibilities.
Anterior Cruciate Ligament (ACL)

Hamstring Grafts (hamstring tendons: semitendinosus- and gracilis tendon)

Through a small incision at the inner shinbone head, the semitendinosus- and gracilis tendon are being removed and then doubled to create a quadruple-transplant (fig.4). Alternatively, when having a sufficiently long semitendinosus tendon, there is also the possibility to remove the semitendinosus tendon only and tie it together to a triple- respectively quadruple bundle.

Advantages of the usage of hamstring tendons are fewer problems with removal, less pain, and cosmetically more favorable scars. Another essential advantage of this method is the hamstring graft gaining almost the natural elasticity of a cruciate ligament during the healing process. Relevant dysfunctions due to the removal of the hamstring do not occur.

Partellar Tendon (tendon below knee cap)

As cruciate ligament replacement, the middle third of the tendon is being removed as “bone-tendon-bone” graft (fig. 5). Advantage of this method is stable fixation and fast bone ingrowth of the transplant.

Disadvantageous however is pain which may occur at the donor site and a possible reduction of muscle power of the thigh extensor muscle. Statistics show that the so-called “anterior knee pain” occurs more often after having had an anterior cruciate ligament reconstruction with patellar tendon than with hamstring graft.

„Double-Bundle“ Reconstruction

Some teams favor currently a new procedure using hamstring tendons in double-bundle constructions. With this technique, replacement of the ACL is made according to its anatomic structure with a doubled transplant string of anteromedial and posterolateral fiber bundles (fig. 6). The higher biomechanical efficiency gained by this double-bundle reconstruction technique however has so far only been proven by experimental simulations. Furthermore, it needs more complex surgery- and anchoring techniques which long-term efficiency regarding optimized knee stabilization has not been shown yet. Within the scope of controlled studies, this method is also being used by us.

Quadriceps Tendon (tendon of thigh extensor)

The quadriceps tendon graft with small patellar bone block is mainly used in revision surgery (re-rupture of cruciate ligament). Although it shows biomechanical characteristics comparable to the natural cruciate ligament, removal of the transplant is very complex and time-consuming, and therefore did not gain general acceptance as first line therapy. Advantage of this method is the possibility of implant-free press-fit anchoring of the quadriceps tendon graft into the thigh bone, whereby biologically optimal healing and simplified surgery in case of revision treatment is ensured. Disadvantages are the demanding surgical procedure for removal of the tendon and weakening of the thigh extension functions.

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Fig. 4: Quadrupled hamstring tendon graft reinforced by Endobuttons® or Retrobuttons®.
(source: Arthrex GmbH)

Fig. 5: Patellar tendon graft as ACL/PCL reconstruction (source: Arthrex GmbH)

Fig. 6: Double-bundle ACL reconstruction (schematic image)
Anterior Cruciate Ligament (ACL)

Donor Tendons
Donor tendons (allografts) are mainly used in America. Advantage of this method is the fact that removal of suitable reconstruction material is no longer required. Disadvantageous however are possible immune responses and the higher failure rate. Usage of donor tendons is being considered as alternative treatment especially with secondary- or third operations when there is lack of the patient’s own transplant possibilities. Since 1993, the ARCUS Clinics are regarded the most experienced specialized surgery unit in Germany using donor tendons for cruciate ligament reconstruction.

Fixation of Cruciate Ligament Grafts
Common aim of all reconstruction techniques is primary stable graft anchorage. For this purpose, there are many different fixation materials such as metallic or bioabsorbable interference screws, staples, pins or fixation buttons available (fig. 7, 8a, 8b). For all systems used at present, an initial retention force which meets post-operative stabilization demands has been certified. In the end, however, anchorage of the implant until complete healing remains the real weak point of cruciate ligament plastics.

Time of Cruciate Ligament Reconstruction
When having a new rupture, treatment in the sense of first line therapy can be done within the first 24 to 48 hours. This option is possible for example when treating an osseous rupture of the cruciate ligament or other concomitant injuries that need immediate medical care (e.g. meniscus ruptures that can be stitched up or complex knee instabilities with rupture of medial- or lateral collateral ligament). In normal cases, surgery is planned after 4-6 weeks when the inflammation has subsided. During this inflamed phase, operative treatment is not recommended due to the proven increased complication rate in the sense of post-operative movement disor-
Anterior Cruciate Ligament (ACL)

ders. Reduction of this “6-week-period” is possible and supportable when the joint becomes irritation-free before.

Until the date selected for surgery, the joint is being treated with functional conservative methods, where the focus lies on how to reduce the swelling and regain functional mobility. Furthermore, preoperative usage of stabilizing knee orthoses is indicated for strong instability symptoms and concomitant lesions of the medial collateral ligament.

Aftercare

Rehabilitation after cruciate ligament reconstruction surgery is an important component of our therapy concept. On the one hand, treatment concentrates on regaining the full range of physiological mobility, full muscular control and coordination, and returning to full activity. On the other hand, current methods of Aftercare are adapted to scientifically proven phases of healing. At present, the accelerated rehabilitation program propagated in the 90ies has given way to adapted and more restrictive postoperative therapy planning which considers individual tissue reactions and the healing process. Today, postoperative care with knee orthoses stabilizing the knee joint is considered standard. With optimal rehabilitation, stable reconstruction of knee joint function and stability can be expected after 6-9 months.

ARCUS rehabilitation program for cruciate ligament reconstruction:

Stationary phase (2-3 days):
Ice-pack and lymph drainage. Start with physiotherapy in the pain free area as well as “walking school” on elbow crutches. Further measures are muscle stimulation, lymph drainage and thrombosis prophylaxis. Removal of redon-drainage the 2nd day after surgery.
Anterior Cruciate Ligament (ACL)

**Post-stationary phase:**
Therapy to reduce swelling, physiotherapy. Primarily work on active stretching, quadriceps isometry, self training, physical exercises and dynamic splint: 1st week 60° of knee reflection, 2nd - 4th week 90°. Afterwards approval of physical mobility.

Increase weight slowly: in first week, only “heel-to-toe” movement of the foot with elbow crutches and with a load of no more than 5 kg is permitted, 2.-3. week about 20 kg, then full body weight can put onto affected leg depending on muscular control and toning.

Coordination- and propriocceptive training (balance board, posturomed, areostep, aqua jogging). Ergometer. Squat- and leg press training possible (in closed system). Please avoid forced stretching against resistance in order to treat the donor site with care.

Sporting activities:
- cycling, walking approx. 6 weeks after surgery
- jogging approx. 3 months after surgery
- contact sports such as football, handball, skiing, tennis approx 6-9 months after surgery

**Medial- or Lateral Collateral Ligament Injuries**

Injuries of the medial collateral ligament can thanks to their tendency to spontaneous healing often be treated conservatively. An exception is a complete rupture of the medial capsular ligament complex with involvement of posterior transverse ligament and dorsomedial capsule. Here, indication for surgery is suture of ruptured ligament structures. Injuries on the outside of the knee joint generally are not being seen as favorable spontaneous prognosis. In these cases immediate surgical reconstruction is needed.

**Posterior Ligament Rupture**

Injuries of the posterior cruciate ligament are mostly the result of a violent weight shift of the lower leg backwards compared to the thigh; for example through direct impact from the front onto the shinbone head. With immediate correct diagnosis, the posterior cruciate ligament injury shows a good spontaneous healing tendency. It requires consequent wearing of a special PTS® splint (fig. 10) which permanently supports and pushes the lower leg to the frontside. Should the “dorsal drawer test” however, remain positive even after several weeks of conservative treatment, surgery is unavoidable.

**Current Surgical Techniques**

Surgical therapy of the posterior cruciate ligament rupture is carried out – as the ACL rupture – on fully endoscopic basis (fig. 11), whereby the patient’s own tendon grafts are used for ligament replacement.
Die effizienteste Form der Quadrizeps-Stimulation*

**Dr. H. H. Pässler, Sven Fell (M. A.): Die Effektivität des kneehab™.**

**ATOS-Klinikzentrum Heidelberg 2006**

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Die Rehabilitation nach Knie- und Hüftoperationen ist oft mühsam und langwierig. Mit Kneehab XP™ kommen Ihre Patienten schneller wieder auf die Beine. Kneehab XP™ verfügt über die einzigartige, patentierte multipath™ Technologie, die deutlich mehr Muskelfasern stimuliert und stärkere Muskelkontraktionen auslöst. Das ist gut für den Quadrizeps und gut für Ihre Patienten – denn es beschleunigt die Heilung um bis zu sieben Tage*.

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Knee-Cap (Patella)

General Information

The knee-cap (patella) is a free running “supporting bone” for the extensor tendon of the thigh. It does not have any firm osseous joint guidance, but is only attached to muscles, tendons and ligaments. It glides in a V-shaped groove of the femur (femoral trochlea or sliding bearing). When having a congenital malformation of the trochlea or in reaction to changes in muscle balance (e.g. after surgery), it is susceptible to problems and injuries. The patient mostly suffers from “anterior knee pain”. The most common diseases are the plica symptom (pain), habitual- or traumatic patella luxation, and cartilage-bone damages at patella and its sliding bearing.

![Fig. 1: Patella / Femur sliding bearing](image)

Plica Syndrome

Here, enlarged synovial folds and thickened synovial membranes might, due to repeated impactions, cause pain or even changes to the free movement of the patella. This could result in uneven- or excessive loading and with this in damages of the cartilage of the knee-cap. If conservative therapy is not sufficient, the plica may be removed arthoscopically.
Knee-Cap (Patella)

Habitual- or Traumatic Patella Luxation

A distinction is made between congenital disorder and acute injuries when having had an accident. The habitual patella (sub) luxation occurs congenitally and instability of knee-cap is due to shallow tracks or weak ligaments and muscles to hold the knee-cap and knee joint capsule. With the traumatic patella luxation instability is usually the result of an accident (luxation towards the outside).

Conservative Therapy

Depending on severity of the knee deviation, a conservative treatment approach can be carried out first. Exercises shall train the vastus medialis muscle regarding leg extension. Important is cooperation of the patient as treatment can only be successful when exercises are consequently being carried out for at least 3-6 months. Longer periods of immobilization and leg rest, however, should be avoided in any case.

Surgical Treatment of Habitual Patella Luxation

In case that conservative treatment alone is not enough, operative measures have to be considered. Depending on cause and detected damages correcting surgery may be necessary. Lateral release (fig. 2+3) and/or medial tightening (fig. 4) are treatment options. Another option for treatment of cartilage damages of the knee-cap or osseous knee-cap luxation may be to transfer piece of the lower leg bone inwards. Here, the attachment of the patellar ligament at the tibia is detached from the bone, and reattached with screws about 1-2 cm further inside. Should the damage be caused by thigh problems, surgical correction of the hip joint may be necessary. Depending on the case, it makes sense to carry out supplemental cartilage therapies and/or a combination of the treatment methods described above.
Knee-Cap (Patella)

Surgical Treatment of Traumatic Patella Luxation

In some cases, when only the joint capsule has been torn by the traumatic patella luxation and caused a haematoma within the knee, an arthroscopic knee washout can be sufficient to prepare the knee for conservative treatment. Operative methods are needed for cracked cartilages or torn medial patellofemoral ligaments (MPFL). Most often, the cracked-off cartilage-bone fragment can be reattached through a small incision, using bioabsorbable anchors. A suture of the cartilage capsule can also be treated with this arthroscopic method. Replacement of a torn MPFL is biomechanically necessary for restoring the patella function and carried out with the patient’s own tendon material from the inner side of the thigh. Similar to ACL reconstruction, the method of choice is minimally-invasive surgery.

Aftercare

During aftercare the patient can put full weight onto the straight leg after 2-3 weeks, squatting or climbing stairs is possible after 5-6 weeks. At this time, an intensive muscle training shall be started to strengthen the especially quick weakening vastus medialis muscle.

Spontaneous Cartilage-Bone Lesions (osteochoondrosis dissecans)

There are cases where the area around the patella and its sliding bearing is not sufficiently supplied with blood and begins to die. At an advanced stage, the cartilage lying above is also destroyed.

Therapy

Initial treatment depends on the stage and is conservative in most cases. Rest, no sporting activities and anti-inflammatory medication may be necessary for pain relief.

If X-ray or MRI examinations show progress of the disease, small holes should be drilled surgically into the center of inflammation to stimulate vascularization and healing. This is called antegrade- or retrograde drilling. In some cases, dead tissue has to be removed before it comes loose and becomes a “joint mouse”. This would cause further cartilage damage to still healthy sections of the joint. Afterwards, the bone lying below is also surgically drilled in order to stimulate vascularization and regeneration of cartilage tissue. In recent years, we have increasingly become able to successfully treat such disorders with bone-cartilage transplants (mosaic plastics, see chapter arthrosis).
Arthrosis

How does a normal joint actually work?

Generally spoken, a joint movably connects the ends of two bones. To avoid these rough bones rubbing against each other directly, these contact surfaces are covered with an approx. 3-4 cm thick layer of cartilage (fig. 1). This layer is extremely smooth, reduces friction within the joint (lower than two smooth ice surfaces against each other) and elastically absorbs shocks when walking. These special mechanical characteristics are maintained by complicated biochemical, molecular and electrophysiological connections and require an intact closed surface and a stable collagen fiber network. This complex “composite material” is produced and controlled by cartilage cells (chondrocytes). Disorders can be of mechanical kind (sudden physical force such as the impact experienced in a car accident, high grade sprains, chronic overweight, varus/valgus malalignment, cruciate ligament instabilities, lacking menisci) or of biomechanical kind (metabolic diseases, rheumatism, gout, calcification, circulatory disorder). Several facts are here ensured: so does reasonable endurance sport, marathon runners included, not increase danger of arthrosis, whereas the varus/valgus alignment especially in combination with meniscus damage, radical meniscus surgery and/or overweight poses a significant risk of arthritis.

Cartilage damage is divided into four different levels of severity:
1. stage: slight superficial fibrillation
2. stage: deeper tear and large surface fibrillations
3. stage: deeper defect (to the bone) with strong fibrillation, mechanically not acceptable
4. stage: exposed bone

Traumatogenic Cartilage Damages

When twisting one’s knee or incurring a contusion as a result of an accident (skiing, playing football etc.) a piece of cartilage (diameter approx. 1-2 cm) may crack off the complete cartilage layer. Surrounding edges are intact and of normal height, the bone below is unaffected and shows good regenerative ability. This kind of damages responds well to all treatment methods mentioned in the following.

Degenerative Wear

Less positive are prospects for cartilage damages developed during one’s lifetime by monotonous stress alone or in conjunction with varus- or valgus deformity, gout, rheumatism, or damages to menisci or cruciate ligaments. These damages soften the cartilage (1. stage) and later result in fibrillation of the complete layer (2. stage). In stage 2-3, the cartilage layer is only half as thick as normal and extremely frayed and there may occur detached or loose fragments of cartilage.

This stage can no longer be repaired by the body itself without outside help. Specialists already talk of severe cartilage damage even though pain may still be bearable for the patient and thus is not perceived as warning signal. Especially this early stage of progressive cartilage degeneration though offers good prospects of successful cartilage surgery. Unfortunately, many patients wait too long.
Arthrosis

In the final stage (4. stage) the cartilage tissue is completely destroyed, the „tyre tread“ completely gone. Bone grinds on bone, grooves develop and osseous overhangs make stretching the leg increasingly difficult. Varus- and valgus deformities increase. Even modern surgical measures for cartilage reconstruction are only limitedly successful in this stage. Real hyaline cartilage cannot regenerate. The only thing an orthopaedic surgeon can do is facilitating growth of replacement- and fiber cartilage and help improving its quality and strenght, or carry out time-consuming cell culture and transplantations which, however, are still quite limited in their range of application.

Basically it can be said that once cartilage damage has begun, the wearing process will continue with increasing speed, and without early therapeutic intervention, freedom from pain can only be achieved by implanting artificial joint prostheses.

Treatment of Arthrosis

Method of treatment depends on cause and severity of the disease. With instruments for arthroscopic surgery we are not only able to see the cartilage damage and record it for later documentation; we can also very gently treat the damage by means of these micro-instruments at the same time.

Debridement

Frayed edges are removed with a mini cutter and the surface is smoothed. Instable cartilage parts are removed to prevent further fraying.

At the same time meniscus damages are being repaired whereby, in an early stage, suturing the meniscus should be the preferred treatment method. In some cases, it makes sense to remove part of the synovial membrane to reduce risk of contusions within the joint.

Methods of Cartilage Regeneration (stem cell techniques)

They base on “migration” of bone marrow stem cells into damaged cartilage areas where they develop into replacement cartilages.

Thus, having a case of half-thickness cartilage defect with furthermore severe fraying, there is still a possibility to stimulate the body’s own cartilage repair. For the first 3-4 years, this replacement cartilage is relatively rich in cells and does not consist of as many cartilage cells (chondrocytes) which produce synovial fluid. Furthermore, it can not stand as much mechanical load as original hyaline-cartilage and therefore often causes knee irritations and knee pain. However, this replacement cartilage (fibrocartilage) is still better than a completely exposed bone. Just compare this damage for example with a burn injury: the skin is wrinkled, less elastic, sensitive to injury, does not get a tan and is hairless - but it is far better than having a permanently open wound.

There are clear indications that in most cases (unfortunately not always) replacement cartilage develops into better load-resistant hyaline-cartilage after several years.
Arthrosis

“Microfracture Technique” (according to Steadman)

Operative beginnings of surgical refreshing of cartilage date back to the 50’s (Pridie drillings). Here, several holes of about 2 mm are sieve-like drilled into the exposed surface of the bone. With this, small “islands of regeneration” are created, but only in few cases a continuing cartilaginous scar tissue. Nowadays, we prefer the less traumatizing “microfracture technique” according to Steadman which has been developed in the early 90s (fig. 3+4).

The bone surface is pierced with a fine awl to create hairline cracks and tiny holes, resulting in a stronger cartilaginous scar tissue to cover the entire affected area.

Just imagine grass seeds on trodden down and dry soil: without previously breaking up the ground, the seed would have no chance to take root. After sowing the seeds, it is not allowed to walk on the lawn for some time to protect it. The same applies to a joint: piercing the bone loosens the bony surface and enables bone marrow stem cells to seep out and potential blood stem cells to settle. And to protect this sensitive area, it is necessary to walk on crutches at the beginning.

Fig. 3: Grade IV cartilage damage at the knee, treatment with micro fracture

Fig. 4: Cartilage repair 1 year after micro fracture

Abrasion Arthroplasty (according to L. L. Johnson)

If parts of the bone are already exposed (4. stage), one treatment possibility is to debride and smooth the remaining bone and wait for improvement. But there is also a chance of helping the body filling bald areas with new cartilage-like scar tissue again – and results can be as good as after treatment with microfracture technique.

We just refresh the exposed, extremely hardened surface of the bone with small cutters, as developed by L. Jonson in the early 80’s.
Different Methods of Cartilage Transplantation

Cartilage-Bone Transplantation (OATS and mosaic plastics)

Small cartilage-bone cylinder-shaped pieces are removed from knee areas with lower physical load and fit into prepared holes in the defective area. Advantage: this method creates immediately functioning hyaline cartilage for the defective area and healing is very fast thanks to the “press-fitted” bony cylinders. Furthermore, expenses are rather limited. However, this method is technically demanding and requires a high degree of surgical expertise and experience, especially when being carried out arthroscopically.

Thus, although seen as routine surgery on knee joint and ankle, it is still not recommendable for shoulder and hip.

Specific demands of ankle surgery: the typical cartilage-bone defect is situated behind the inner ankle, inaccessible from the front. Thus, the inner ankle has to be detached first to be able to press the donor-cylinder extracted from the knee (the ankle joint does not have enough cartilage tissue to create a transplant) into the defect of the talus, and then screwed back in afterwards.

Problems finding donor sites arise in about 10% of all cases when 1-2 donor cylinders shall be extracted. Therefore, the amount of donor cylinders is limited. There exist artificial, absorbable plugs with cartilage-like characteristics (Trufit®, fig. 7), which have proven to be very successful in filling up these donor-holes. In some cases, smaller defects (also at ankle joint) can be treated with such absorbable plugs immediately. After 1-2 years these plugs are replaced by the body’s own bone-, cartilage- and connective tissue cells.

Cartilage Cell Cultivation = Autologous Chondrocyte Transplantation ACT

This method caused quite a stir in the media in the mid 1990’s. In a first operation, several cartilage particles are removed from the knee joint, propagated in a complex cell culture and finally implanted in the defective area in a second surgical procedure. The new cells have to grow and propagate further cells for a new cartilaginous structure – a very complex process that requires strict adherence to Aftercare guidelines given; that may include walking on crutches for 8-10 weeks. During this time, enough exercise with a continuous passive motion device (4-6 weeks, 4-6 hours each day)
Arthrosis

as after microfracture treatment is necessary, respectively strongly recommended by us. With this exercise, formation of a good and stable new cartilage surface is essentially supported (see below).

In some cases, after verification of the diagnosis and indication, approval of cost transfer has to be obtained from the health insurance company first before cell removal and transplantation afterwards can be carried out. Thus, bureaucracy sometimes makes 3 surgical steps necessary.

And costs are high; the cultivation of new cells in a laboratory alone costs 4,500.00 – 8,000.00 Euros – and is covered from public health insurance companies only for part of the patients. Furthermore, operation technique is very demanding and may require a second surgical procedure, let alone the arthroscopically controlled check after 1-2 years.

All these methods can help rebuilding the attacked or worn cartilage layer of the joint. However, this can only be successful if any possible causal disturbance factor has been eliminated:

• Meniscal lesions have to be smoothed or even better sutured. Meniscus transplantations are so far not available for wider clinical usage.

• Ligament instabilities have to be eliminated, especially the anterior cruciate ligament (ACL) has to be sufficiently stable.

• Leg axes need to be straight (see chapter varus/valgus malalignment).

• Overweight shall consequently be reduced until a body mass index of less than 25 is reached. This is done by reducing food intake and starting sporting activities (at the beginning in the water).

Aftercare for joint-preserving Arthrosis Treatment

See chapter varus/valgus malalignment page 46.
Arthrosis

Results

Until today, there unfortunately has not been found any general patent remedy for the advanced stage of the degenerative joint disease – except for artificial joint reconstruction which should be delayed as long as possible. With treatment by continuous passive exercise the Canadian R. Salter achieved excellent results already in 1984 (in an animal experiment with a 6 weeks continuous training even in cases of severe joint damage). Of course, on the one hand, a human patient cannot be tied to a motion device for 6 weeks, and on the other hand many diseases heal much faster and better with animals than with humans. However, we think that this aftercare concept is a revolutionary method for the future.

Our experiences with abrasion arthroplasty for arthrosis treatment – whether with or without continuous passive motion - date back to its beginnings in Germany in 1984. In own tests carried out during aftercare we can, similar to the American studies, achieve good and satisfying results in about 60-70%. Please consider that without any treatment constant worsening of joint functions has to be expected.

Supportive Medication Therapy

Injections with hyaluronic acid have shown to be successful in improving joint lubrication, and we at the ARCUS Clinic are very proud to have actively contributet to the launch of hyaluronic acid in Germany in the early 90’s. A step that has proven to be successful in the long term. In extensive studies, hyaluronic acid has mainly been proven positive. Generally, a series of 3 to 5 injections is recommended (at the price of approx. 230 euros each/status 2009). Unfortunately, neither public health insurance companies nor the employers’ liability insurance association are willing to pay for this treatment so far; the patient is yet again self-payer.

In order to support cartilage repair, we recommend an additional long-term therapy with cartilage builders glucosamine and chondroitin (e.g. 3x1 capsule ARTROSTAR ®). This combination of approx. 1500 mg glucosamine and approx. 1200 mg chondroitin sulfate per day is commonly regarded as supportive cartilage therapy. International studies and in the meantime working groups in Germany as well are proving the anti-inflammatory- and cartilage supporting characteristics of these substances which furthermore are free of unpleasant gastrointestinal side effects such as the for cartilage unfavorable NSAR. A capsule of ARTROSTAR ® contains 500 mg glucosamine HCL and 400 mg chondroitin sulfate. Unfortunately, public health insurance companies do not pay for this treatment. Positive effects of homeopathic medicines such as Zeel® or Ney Arthros® are much less proven and only a few treatments are normally not suitable as therapy approach.
**Exercise Therapy**

The best thing you can do for your joint is to have plenty of exercise while avoiding overexertion, e.g. by loosing weight, wearing well-padded shoes in the initial phase, avoiding long walks/runs on hard surfaces such as asphalt etc. Train your muscles with slowly increasing endurance sports. Suitable are “soft straightforward sports” such as cycling, walking, Nordic walking and swimming.

**New Physiotherapy Options:**

- Aqua jogging which enables intensive circulatory- and muscular training without overloading the affected knee.
- Reflective muscle training with the whole body vibrator type Galileo. The patient stands on a plate vibrating with about 40 Hz what is automatically balanced by the muscles. This has already been proven to be an effective training method for muscles and bones. We are currently investigating positive effects on cartilage regeneration after the surgical procedures mentioned above.

**Tips for Further Improvement of Treatment Success:**

- Stick to the period of no or restricted weight-bearing given by us.
- Move your joint as intensively as possible without overloading it.
- Make use of the advantages of hyaluronic acid injections for the affected joint: start first series 3 weeks after surgery; repeat after 6-12 months.
- Work consequently on weight reduction. Even a few kilograms less add up with 2-3 million steps per year as a knee-, ankle- or hip joint is loaded with the 2 to 5 fold of body weight; depending on height of step.
- Drink enough water (instead of coffee or soft drinks) so that body and cartilage do not become dehydrated and with this brittle and prone to injuries.
- Train your joints according to a varied program:
  - In the initial build-up phase, about 2-6 months after surgery soft, we recommend guided movements without transmitting the load of body weight such as cycling or water training. Then slowly start with walking / Nordic walking e.g. also combined with special training shoes (MBT-shoes).
  - Later you can add a mixture of cross-training, running (at the beginning on hard ground, then cross-country), as well as total body exercise in the gym.
- Accept that not every joint affected by arthrosis can regain its former sporting ability.
- Keep to the follow-up appointments stipulated.
- Make use of our offer for an arthroscopic check about 1 year after surgery.
- Please consider that without any treatment constant worsening of joint functions has to be expected.
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Modern Therapy Methods in Orthopaedics / Trauma Surgery

Tissue Regeneration Principles

Different types of human tissue need different time periods for regeneration. An injury of the oral mucosa for example heals completely within a few days, muscle injuries need 3-4 weeks, bones usually 6-12 weeks.

It has been known for some time now, that any information needed for the formation of new tissue cells lies in these cells and in-between areas as well as to a large extent within the platelets.

Bone Growth Factors:

Research to this topic dates back until far into the 80’s, and since the mid-90’s, concentrates of such collagenous bone growth factors, gained of animal bone extract, are allowed as preparation and for clinical use. In 1997, the ARCUS Clinics have been one of the first orthopaedic specialist units to officially use these bone growth factors, and since then has been treating hundreds of bone defects that do not normally heal very successfully. Particularly suitable is this material for very problematic bone healing processes with infections (infected pseudo-arthrosis).

Besides such concentrates which provide a huge number of bone growth factors in the perfect mixture ratio quasi as seed capital for bone healing, there are also treatment possibilities with isolated special factors (e.g. BMP7). However, they have to be given in a local overdose what may increase possible unwanted side effects.

Growth Factors of Platelets PRP (Platelet Rich Plasma)

In recent years, treatment with the body’s own growth factors - 10 to 60 ml of the patient’s own blood which is specially prepared and centrifuged – has become more and more popular. Here, growth factors within the platelets are enriched and the liquid gained (several milliliters) is given into the areas with low healing tendency (e.g. Achilles tendon- or meniscus suture). And there are also many cases in which artificial bone material is saturated with those factors to fill bone defects. The advantage is improvement of healing free of side effects, especially in cases with unfavorable conditions. Another new treatment method is injecting the patient’s own factors directly into the affected area. When using this method at the Achilles tendon, the patient is with suitable orthotic shoe inlays capable of walking already after 4-5 weeks thanks to good healing acceleration.
Support of Cartilage Repair

Real regrowth of original cartilage substance is still a dream. But nevertheless we have learned a lot about cartilage reconstruction (fibrous cartilage) and how it can be improved to become a more stable long-term scar. Besides operative requirements, injection therapy with hyaluronic acid has become an important factor. It does not only reduce friction (with “synovial fluid”) but affected cartilage cells are also provided an immediately functioning basic frame for formation of cartilage as “composite material”. Furthermore, hyaluronic acid increases, and that is very important, the water-binding capacity of the attacked and frayed cartilage. It becomes more elastic and nutrition of cartilage cells is improved by the water flowing in and out with every step. More water molecules in turn increase the piezoelectric effect to which the biological meaning of stimulation of cartilage metabolism is attributed.

There is enough literature available about the positive effects of hyaluronic acid therapy. It is no coincidence that more and more orthopaedists and surgeons recommend this therapy. They daily experience patients which achieve an improvement of their symptoms - in some cases already after the third injection - and that this condition lasts for 6-12 months (after a therapy of only 3-5 injections). That is incredibly much longer than the pure biochemical half-life of molecules within a joint which in most cases is 1-3 days.

Unfortunately, decision-making committees of public insurance companies refer to the few neutral or negative studies (which can be found on every scientifically discussed problem) and the current situation is: self-payer status.

Costs

Our surgeons at the ARCUS Clinics are highly qualified specialists which always offer the latest state-of-the-art surgical techniques, as far as they have proven to be successful. To what extent health insurance companies are willing to pay for the respective treatments however, has to be checked in each individual case. Unfortunately we cannot give any generally binding statement as to how one or another medical progress will be reflected in cost transfer of public- or private health insurance companies in the future.

We care about your health. Therefore we will always offer you the most promising treatment options; regardless of the cost situation. In a personal interview we will see which treatment option suits you and your needs. We will always be at your disposal to inform you about minimally necessary measures, the recommended therapy and an optimal, comprehensive and holistic treatment.
Knee Malalignment (varus-/valgus malalignment)

Transposition Osteotomy for Treatment of Knee Malalignments

Normally the leg axis should be straight. Small deviations into bandy-leg (mostly men) or knock-knees (mostly women) are not regarded as disease. Problematic however are bigger deviations as well as partial meniscectomy, chronical instability (old cruciate ligament rupture) and continuing knee overload e.g. through ball games, tennis, intensive skiing etc..

Conservative Treatment Options

- Reduction of knee load by changing to more gentle sports (e.g. swimming, cycling, walking, training in gym etc.). This also includes reasonable muscle- and coordination training. In many cases, elastic joint bandages can help improving perception of joint movements (proprioception).
- Reduction of body weight (what you always wanted to do).
- Marginal elevations on shoe soles.
- Focused walking instructions after walking analysis and provision of inlays if necessary.
- Hyaluronic acid injections into arthritis joint (in the meantime proven successful and by specialists approved). Or injection of the body’s own growth factors (first results are positive). These modern biological treatment methods however, are so far not covered by public health insurance companies.
- Regular intake of a combination of glucosamin- and chondroitin capsules. They contain elements of the bone matrix, are favored particularly in the USA, and are said to have the same pain reducing effect than usual rheumatism medicines (e.g. Diclofenac), but without side effects. Recommended is a daily dosage of 1500 mg glucosamine and 1200 mg chondroitin.

Surgical Treatment Options

In the case of severe symptoms, serious leg axis deformities or high sporting activity, anatomic correction of the knee malalignment should be discussed in order to delay the time of knee joint prosthesis. Such correcting measures will furthermore support the conservative therapy options mentioned above to be successful. The typical age is between 30 and 60 years. Beyond this age, the recovery rate of 80% will decrease considerably and an artificial knee joint (knee resurfacing) will certainly be of more help to the patient.

Treating a varus deformity the most common method is opening up the inner side, or removing a v-shaped piece of bone on the outer side of the shinbone head. Correction of a valgus deformity is carried out just above the knee joint. In both cases, the bone is carefully severed and then precisely positioned to be fixed again with metal clamps or screws until healing of this artificially created “fracture”. By using
Knee Malalignment (varus-/valgus malalignment)

so-called stably-angled plates and screws the healing process has considerably been improved in recent years:

- reduced pain
- improved mobility
- possibility of a reliable healing rate.

Such treatments can normally be combined with cartilage regeneration- or cartilage transplantation procedures. All metal parts used are removed after 1 year when carrying out an arthroscopically controlled check. Insufficiently healed cartilage can immediately be treated again.

Even if it seems to be a serious surgical treatment: these correction measures heal faster than cartilage within the knee joint as it needs time for creation of a new cartilage layer, the so-called “bioprosthesis”. By combining all these surgical therapy methods (operative refreshment of arthrosis and cartilage transplantation if necessary, correcting measures for knee deformities, cartilage supportive hyaluronic injections) it is today in fact possible to stimulate regrowth of new stable cartilage tissue.

![Fig. 1: Bow-leg deformity with single-sided wear of inner joint space](image1)

![Fig. 3: Stably-angled spread-up correction of bow-legged lower leg](image3)

![Fig. 4: Stably-angled spread-up correction at thigh](image4)

Aftercare for joint-preserving Arthrosis Treatment:

Depending on severity and extent of the arthrosis, walking on forearm crutches to keep pressure off the affected area might be necessary for up to 10 weeks. During the first 4-6 weeks, only a “heel-to-toe” movement of the foot with a load of not more than 5 kg is permitted; during the following 2-6 weeks about 20 kg (walking on crutches is still necessary). In this period in some cases even driving is possible. Cars with automatic transmission can be driven much earlier with operated left knee joint. For the whole time though, you should move your joint as much as possible. Therefore we prescribe use of a continuous passive motion device. The more often you use this device (at least 4 hours per day and additionally 2-3 hours at night) the better the result (proven by numerous studies).

![Fig. 2: X-ray image of whole leg with planning scheme for determination of correction angle](image2)
Knee Malalignment (varus-/valgus malalignment)

Should your joint react with swelling and pain after these 8-10 weeks of careful rehabilitation training, it is still not ready to carry your whole body weight. Another phase without too much pressure, further medication and external treatment measures such as radiotherapy and ointment bandages is inevitable. Please don’t give up in this hard time, as after 3-6 months (in rare cases up to 9 months) noticeable and lasting improvement, even in cases with severe arthrosis, will show up.

Until today, there unfortunately has not been found any general patent remedy for the advanced stage of the degenerative joint disease – except for artificial joint reconstruction which should be delayed as long as possible. Please consider that without any treatment constant worsening of joint functions has to be expected.
Knee Endoprosthetics

General Information

Arthrosis stands for the degenerative wear of joint partners rubbing against each other (cartilage wear). Healthy joints are covered with a cartilage layer in order to improve sliding properties. However, there are cases when these joint surfaces are such worn, that the underlying bone surfaces are in direct contact and there is no more chance for improvement by arthroscopic cartilage shaving (joint arthroscopy) or osseous joint transposition. Here, artificial replacement of the joint is in most cases a reasonable alternative to joint reconstruction. Major aim is long-lastingly reduce pain and rebuild the patient’s physical activity.

Already more than hundred years ago there have been made attempts to artificially replace painful joints. First successes were achieved in the 60’s and many prostheses of this time had a long life-time. Since then, the number of artificial joints implanted has continuously increased. Today, more than 300 000 hip- and knee joints are successfully used every year in Germany. Thanks to the good results of the last decades, artificial shoulder joint replacement is experiencing a growing number too.

This artificial joint is a so-called endoprosthesis (Greek: endo-inside) and is often also called total endoprosthesis as both joint segments are replaced by an artificial surface respectively an artificial joint partner. In case that only one joint segment is replaced, it is called hemi-endoprosthesis. This form is sometimes used for treatment of shoulder fractures. At hip- and knee joint however, always both parts of the joint are replaced as they carry the whole body weight and a hemi-prosthesis does not ensure sufficient pain reduction.

Of course there are also risks with endoprosthetics as it is a complex and challenging surgical procedure. Nowadays, implanting an artificial joint replacement is a routine operation but possible complications such as inflammation, thrombosis (blood clots) or damage of surrounding structures (nerves and vessels) cannot be excluded. Therefore, such surgical treatment should only be carried out in specialized units which have sufficient experiences with of artificial joint replacement. As parts of the joint are replaced by metal implants, loosening of the prosthesis can happen in the long term. However, a lifespan of more than 25 years is possible with hip prostheses. This depends on the one hand on the implants and the anchoring technique used, but on the other hand also on the surgeon and its experience.

Used materials correspond to highest demands. They shall ensure highest sliding properties with minimal friction and at the same time have the lowest wearing effect as possible. Therefore, they are adjusted to each other perfectly and selected accordingly. Today, the most common materials used are: metal alloys (titanium- and cobalt-chromium-alloys), plastics (polyethylene) and ceramics (aluminium- or zirconium oxide).
Anatomy and Functions

The biggest human joint is the movable connection between femur and tibia and consists of three parts: an inside and an outside section of the joint between the femur and the tibia (femorotibial joint), in between in the joint gap the menisci, and the third part which lies between patella (kneecap) and thigh bone (patellofemoral joint).

All parts of the joint are covered with a cartilaginous layer and are enclosed in a common joint capsule. The synovial membrane produces a liquid that nurtures the cartilage which has together with the menisci a shock absorbing effect. Ligament structures between the bones stabilize the joint (e.g. cruciate- and collateral ligaments); muscles and tendons ensure movability of the joint (primarily straightening and bending). With bent knees, small rotational movements are also possible.

Knee Joint Arthrosis (gonarthrosis)

Most common reason for a knee joint disease is cartilage wear (arthrosis), which is mainly caused by leg axis deformities (varus- or valgus malalignment). Moreover, gonarthrosis may occur as the consequence of injuries, rheumatic- and metabolic disorders as well as deformities.

Loss of cartilage results in increasing stiffening and deformation of the joint, whereby stretching is in most cases the first movement to be lost. Osseous overhangs (osteophytes) form which in some cases even can be felt through the skin. At the same time, the pain occurs; at the beginning only in association with initial movements or periods of stress, later also at night and at rest. This results in increasing reduction of walking distances and finally in limitation of the quality of life.

Arthrosis can be seen in a normal X-ray image, whereby the narrowing of the joint cavity between femur and tibia is regarded as indirect sign of cartilage loss. Joint
Knee Endoprosthetics

surfaces are often destroyed and do not optimally fit together, and the leg axis becomes more and more deformed (bow-leg or knock-knee malposition). Moreover, the joint may swell due to the permanent irritation.

Knee Joint Prosthesis: Material – Fixation - Durability

If a joint maintaining therapy is not possible due to severity of the damage or because of the age of the patient, and all other conservative and surgical options (physiotherapy, painkillers, joint irrigation etc.) have been tried, a total knee replacement is necessary (TKR).

Major aim of this surgical procedure is a pain-free, stable and movable knee joint whereby the natural leg axis is restored.

Operation techniques and implants which have been more and more improved over the last decades make this therapy method to one of the most common and most successful routine operations in orthopaedic surgery (with about 150 surgeries per year in Germany).

The knee endoprostheses used these days are known as resurfacing implants as they only replace worn cartilage surfaces, while preserving the patient’s own knee ligament structures. Depending on the severity of the arthrosis, there are different types of prostheses which do only replace frayed parts of the joint and support healthy areas.

Generally a distinction is made between the following types of prostheses:

- **Unicompartmental prostheses** (fig. 1, 4, 5) (unicondylar sledge or patellofemoral replacement): the isolated replacement of only one joint segment requires the other segments to be affected only very slightly and the ligament structures to be intact.

- **Bicompartmental prostheses** (fig. 2, 6) (mono- or bicondylar).
  1) Monocondylar prostheses only replace inner (medial) joint segments and the joint between patella and thigh.
  2) Bicondylar prostheses (TKR) replace joint surfaces of inner (medial) and outer (lateral) joint segments, while maintaining the patient’s own ligament structures as far as possible. The segments of thigh and lower leg are not mechanically linked with each other. In case that the ligament structures are damaged, a cylinder-shaped connection of both segments enables stabilization of the joint even without ligaments. Knee endoprostheses lying parallel to the bone which were formerly used very often, dispense preserving the patient’s own ligament structures under resection of large bone areas. Today, these prostheses are used only in exceptional cases.

All prosthesis types are available in different sizes; by means of the pre-operative planning sketch, model size and fixation of the prosthesis are specified. Here, individual requirements such as age, gender, shape of bone, body weight etc., are taken into consideration. According to this planning, leg axes are measured and the prosthesis planned in its alignment.
There exist different fixation techniques for implantations: The cemented TKR is regarded as the “gold standard” worldwide. Here, the implants are fixed to the bone with antibiotic cement. In rare cases, also the cement-free “press-fit” anchoring technique can be used. Depending on the fixation technique used, the components are either made of titanium or a chrome-cobalt alloy. As gliding support a polyethylene inlay is inserted between the replaced surfaces, which is either fixed to the basis plate or rotates and glides between the surfaces (mobile inlay).

Regardless of the fixation type, a life-span of normally 12-15 years is expected. When being in a good physical condition, second surgery to change the prosthesis can be carried out at any time. Here, special prostheses are available for any stage of bone defects.

**Treatment prior to Surgery and Surgical Procedure**

Surgery is preceded by an in-depth patient interview, clinical and radiological examinations and detailed planning. Additionally, an internistic/anaesthesiological check including ECG, pulmonary function- and blood test is carried out. In most cases the operation is carried out using a tourniquet, and need for allogenic- or autologous blood can normally be excluded. The blood collected in the drainage during surgery can at the end be led back to the patient via a feedback system. Stationary (in-patient) admission usually takes place the day of surgery.

Depending on the individual arrangement made, the operation is carried out under general anaesthesia or spinal anaesthesia. Access to the affected joint is conducted through an approx. 10 cm long incision at the front side of the knee. When having removed the destroyed joint surfaces with precision instruments, the prosthesis components are fixed to the femur and the tibia. Due to the general public opinion and own experiences, replacement of the posterior patella surface is only carried out in cases of severe damage. When having checked the artificial joint for mobility, the wound is closed layer by layer with insertion of drainage tubes. Finally, a control X-ray is taken after surgery.
Knee Endoprosthetics

Aftercare

Joint replacement operations are exclusively carried out under in-patient conditions. In order to ensure optimal success, early postoperative mobilization by means of physiotherapy is strongly recommended. Depending on the already mentioned techniques for implantation, in most cases immediate load on the operated leg is permitted. However, crutches have to be used for 4-6 weeks to protect the soft part tissue. For most patients, the stay in the clinic of about 7-10 days is followed by a 3-week rehabilitation program. Within the scope of regular, outpatient check-ups at close intervals, the progress of the patient is documented and if necessary the mobilization therapy prolonged.

Joint Replacement and Sports

Having a severe knee joint arthrosis, noticeable limitation of physical activities has to be expected. When the symptoms are gone after joint replacement surgery, the desire for more sportive exercise certainly comes up again. Internationally there is a broad consensus that at least so-called “low-impact” sports such as cycling, swimming, sailing, diving, playing golf and bowling can be supported. Sports such as tennis, basket ball and skiing however, are only possible to a limited extent. Completely avoided shall be contact sports such as football or hand ball. Recommendations for those different sports are also dependent on the patient's performance level. As a rule of thumb it can be said that sports practiced prior to surgery are allowed afterwards as well.