Notification

If your knee hurts (Part 1)

By Dr Ullrich Gebhardt

Illnesses in the joints, muscles, supporting system and musculoskeletal system have lead to huge economic problems over the past decade.

Approximately 10% of the population is affected by arthrosis, a condition which leads to wearing of the joints causing pain, inflammation and restriction of movement.
In Germany approximately 8 million people suffer from joint problems. 90% of these people are over 65 and approximately 17% of those over 34 suffer from painful joint degeneration. These statistics clearly show the importance in treating musco-skeletal illnesses. Paessler, Heidelberg states that more than 11.3 million consultations take place annually in Germany with either an orthopaedist or surgeon due to knee problems alone. And this number is increasing. Hyaline cartilage is a central component of every joint, but does not regenerate itself. In humans, joint-cartilage consists of between 70-80% water and 1-10% cartilage cells. Human joint-cartilage has the following properties: it has a smooth surface-layer and acts as a shock absorber. The top layer is the most flexible. They are free of blood and lymphatic vessels and do not contain any nerve-endings. Nutrition to the cartilage comes solely from surrounding tissue by act of diffusion. They have a slow metabolism and are not more than 7mm thick. As they cannot self-repair, joint cartilage in humans is quite an important part of the body to keep healthy. Both healthy and damaged joint cartilage consists of very robust tissue which can cope with millions of movement-cycles for up to 80 years.

What are the causes for Arthrosis (wear) of the joints, including human knee joints?
Accidents, metabolism illnesses (gout, obesity) and genetic illnesses can cause cartilage-damage. Being overweight for a prolonged period of time leads to an overloading effect on joint cartilage. Continuous overloading or uneven loading on the joints can also lead to cartilage damage as well as congenital and angular misalignment. A very high proportion of knee-joint wear and tear involves ligament rupture and instability mainly due to sporting injuries, with the rupturing of anterior or posterior cruciate-ligaments and other parts of the leg associated with such injuries. Even a so called arthrosis-gene has been brought into question. We often do not know the causes for cartilage damage. Up to 83% of cartilage damage in humans occurs in the inner part of the joint. Contemporary cartilage therapy should be carried out early, aiming at being as regenerative as possible. Patients suffering from widespread joint-damage or signs of wear, in particularly for knee-joints as they're a particularly loaded joint with patients often complaining of pain. In years gone by, due to incorrect procedures dealing with joint injuries, it was usual for patients to have to wait until the articular cartilage had worn down, causing the bone-surfaces to grind against each other. Even then, patients were often told they had to wait until they were old enough, before receiving an artificial joint. In sight of this, there have been huge changes implemented in the past few years. A multiple number of successful therapies have been set-up that regenerate the articular cartilage shortly after damage has occurred, leading to the effects of joint-wear, or arthrosis, either being postponed or completely avoided. The selection of the appropriate therapy to combat joint-damage varies from patient to patient. It depends on the scale, depth, and positioning of the defect in the joint. The patient's actions, strength, and loading on the joint all play a role in treating cartilage damage. Additionally, related joint injuries such as ligament instability (cruciate-ligaments), meniscus injuries and biomechanical changes to the leg's axis need to be considered when selecting the appropriate treatment. In order to permit positive results from joint-therapy, it is important that these accompanying factors are duly taken into account when deciding upon the appropriate treatment for degenerative illnesses. Finally, patients suffering from articular cartilage damage should receive long-term treatment adapted to their individual needs.

What modern treatments are available for joint-therapy?

1. **Conservative approach to joint-damage treatment**
   For joint-damage not requiring operative surgery (i.e. patients with little pain complaint), physiotherapy and orthopaedic treatments such as using insoles or braces can be used to help stabilise a joint and also to relieve pressure on a single damaged articulated section. Through physical treatments such as warm and cold therapy, lymph-drainage, ultrasound, can have a positive effect on inflamed areas of the tendons and articular capsule.

Medicines such as non-steroidal antiphlogistics known as diclofenac compounds lead to a reduction of inflammation and joint-pain and are a very good therapeutical complement for new injuries or for after recent surgery. A variety of cartilage compounds and nutritional supplements are available commercially. Due to them being able to temporarily relieve symptoms quite well, they are a suitable supplementary option. The best known and most effective supplement however is hyaluronic acid. Conservative treatment-methods cannot achieve an identical regeneration of the hyaline cartilage.

2. **Reattaching detached bone cartilage fragments**
   This procedure is applied for injuries in which cartilage bone fragments have become detached. It relates to so called “shearing traumas.” These mostly come under the category of patella dislocations (luxations). These cartilage-bone-fragments are often well adjusted and fixed with self dissolving fixation materials such as pins or screws. Under cheaper conditions, it is possible to fix such defects using certain adhesives. The successful healing of such cartilage-bone-fragments is depends on the solid joining of the cartilage-bone component with the base of the bone.

3. **So called “Tissue-Response-Method” (cartilage structuring procedure)**
   If cartilage damage is detected during joint endoscopy, the bone lamella underneath the defected cartilage is opened using a special chisel. Blood comes out of bones through the opening in the bone lamella, forming a hemangioma in the defected area containing regeneration cells (stem cells). In order to increase the number of cells in the defected area, it has recently been attempted to use the Tissue Response Technique (also known as micro-fracturing), to join an arthroscopic covering to the defected cartilage. Such a membrane can of course be glued to or stitched to the defected area through a small opening in the joint.
   Conclusive studies regarding the probation of this method are not quite yet very definitive. These methods lead to a high percentage of cartilage defects being closed creating either scarring or fibrous cartilage. Fibrous cartilage is not as strong as healthy cartilage however the effect of the defect is reduced. It cannot be stated how much hyaline cartilage there will be while adopting this method. Restricting factors with this method include the defect-size and defect-depth.
   During after-treatment, partial-loadings must be subjected to the corresponding extremity for a minimum of 6 weeks, whereby the patient should mobilise the joint. Motorised knee mobility splints have especially been proven effective when used immediately after such operations. This is because passive movements in the operated joint lead to the improved regeneration new cells in the defected area. Using this personalised after-treatment, which for best results should be controlled by one person, regeneration cells form scar-tissue around the defected area over the following months. This scar tissue has significant differing biomechanical properties to normal healthy joint-cartilage. It is weaker and considerably less shock-resistant.
   In cases where cartilage damage is minimal (up to 2cm squared in size) or in a low-loaded area, this therapy can be very successful, especially with young people.
   The advantage of this method is that its arthroscopic feasibility makes it minimally invasive, the procedure doesn’t take long to carry out and it is relatively simple. The disadvantage of this method is it’s time consuming after-treatment. The regeneration-potential in large defects is low and can lead to complications such as irregular regeneration or calcification. With this in mind, other treatments can be considered.

4. **Osteochrondal transplantation (transferring healthy cartilage-bone-cylinders into the cartilage-defect)**
   Using this method, cartilage-bone-cylinders are taken from a low loaded joint-surface and precisely implanted into the defective area using specialist instruments. Such a cylinder requires a sufficiently large and boned-enough surface, in order to heal to the surrounding bone and also in order to be sufficiently supplied with blood. In order to minimise pain in the implant area, this method can only be applied on defects with a maximum area of approximately 3cm squared, as there is only so much cartilage-bone-cylinder that you can remove from a joint. In smaller defect cases this can be carried out without even having to open up the joint using a joint-endoscopy.

5. **Autologous chrondrocyte transplantation (ACT), cartilage transplant**
   Autolous chrondrocyte transplantation is understood as being the transferring of hyalines, the body’s own cartilage cells into the defected area. This method has been used

successfully over the past 15 years in treating above all cases resulting from accidents or from cartilage nutritional disorders. This treatment is used for defects larger than 3cm squared and has been shown to be successful on defects up to 10cm squared. This treatment is for patients aged between 17 to 45-50. It should not be used for treating cartilage surface abrasions (joint arthrosis) or to treat wearing of the joint.

How does this treatment work?

Fundamentally, the patient needs to undergo two operations. Through a procedure involving the removal of cartilage-samples from a non-loaded part of the joint, cartilage-cells can then be extracted and reproduced in a specially equipped laboratory. After the necessary cell-count has been achieved, the cartilage cells will then be placed into a three dimensional sponge-structure that largely resembles the original biological cellular microenvironment in the cartilage. The cells will then start to produce the new cartilage tissue. Approximately 3-4 weeks after the removal of these cartilage cells using joint endoscopy, the corresponding membrane will be implanted into the defected area. This is carried out through a small opening in the joint. Once a small 5-7cm long incision has been made, the damaged cartilage is removed and the transplant (of exactly the same dimension as the removed cartilage) is then inserted in its place. It can be fixed into place using tissue adhesive, stitches or self-dissolving pins. After the operation, the patient should only apply small loadings to the joint for up to half a year. After-treatment will involve physiotherapy, preferably from a surgeon, and the use of motorised knee mobility splints. Cartilage-tissue takes several years to fully heal in cases requiring this form of treatment. At the start of this treatment, a flap of skin was taken from the lower-leg and sewed into the periosteum.

The basic principle of this treatment is the bioactive cavity, in which joint-cartilage tissue regenerates with a very high proportion of hyaline and shock-absorbent cartilage. Despite this, this treatment is not suitable for all patients. Due to health insurance limitations, this treatment can only be applied as much as the health-budget allows per annum. From a health-political point of view, this treatment has been proven effective in treating cartilage defects, but only provided the corresponding signs and contraindications are thoroughly considered beforehand. This treatment should not be attempted in cases including metabolic disease, advanced wear, axis malformations, ligament instability, loss of menisci, inflammations, or with patients who don't follow their doctor's instructions as it will not be successful. Modern cartilage therapy involves the treatment of structural damage in the joint. This especially applies to treating ligament instability (both front and back cruciate-ligaments), menisci injuries and axial deformations. This fundamentally shows the importance of selecting and managing the correct treatment for metabolic diseases such as gout.

6. **Covering the cartilage-defect using plastic materials**

This is also a well-established procedure, combining special operating instruments and lots of experience on the side of the surgeon. In certain cases, cartilage-defects can be treated using plastic materials onto which the cells can be placed and covered with titanium plates. With this method, the covering is screwed into the defected area. In this document I cannot point out all treatment options. It is especially important to treat instability when maintaining human cartilage, especially in the cases of cruciate-ligament injuries. Menisci should be removed as sparingly as possible, as these important joint stabilisers need to be maintained. During cartilage therapy, the patient's pain management as well as lifestyle (i.e. not being overweight) need to be taken in to consideration. Professionally managed physiotherapy for this treatment-procedure is of great importance.

Relevant literature-sources from the author.

Patient information

In medicine, success can never by guaranteed. For this reason, before a patient receives treatment, they should always have had the possible risks and contraindications explained to them, and no pressure on them to react quickly to their symptoms should be exerted.

Further reading

Edition 2 on 16.06.10 *(KW24)* in the Wochenkurier:

The front and rear cruciate-ligaments

Edition 3 on 22.09.10 *(JW38)* in the Wochenkurier

Injuries to the front cruciate-ligaments in children

Menisci

Edition 4 on 29.12.10 *(KW52)* in the Wochenkurier

Changes to the leg's mechanical-axis

Transposition-osteotomy

The half knee-joint

Hemiprothesis or unicondylar prothesis

Knee-arthroplasy

Summary

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