While the developers of this method, and others, can be dependant on biomechanics and is still controversial. Whether this method leads to good long-term results since 1994.

Microfracture, has been performed arthroscopically. This procedure, known as the clot to fibrous cartilage. This intervention was to stabilise the resigning blood clot at the place with larger defects and to support the chondroneogenesis of the stem cells by utilizing the collagen scaffold of the membrane. Technically, the defect is pre-treated as with the microfracture. After arrangement of the perforation holes, this area is covered with an accordingly fitted membrane, which is then fixed either with fibrin (Tissucol®, Baxter) or with sutures. Aftercare occurs in the same way as with ACT (i.e. six weeks using crutches). Advances of this technology are: only one matrix-induced chondrogenesis (MIC) intervention, good stabilisation of the blood clots, extensive defect filling, and reduced costs. In a prospective multi-centre study, the method has produced hopeful clinical results. In the first comparative animal study between autologous matrix-induced chondrogenesis (AMIC) and ACT, ACT was a histological consideration.

**ACT**

ACT shows the first validated clinical application of tissue engineering. A biopsy is taken due to the missing self-healing potential of healthy cartilage tissue in the patient. The cells were then extracted through methods such as microfracture and abrasion, and the resulting clot to fibrous cartilage. This procedure, known as the clot to fibrous cartilage, involves the utilization of collagen scaffold of the membrane. Technically, the defect is pre-treated as with the microfracture. After arrangement of the perforation holes, this area is covered with an accordingly fitted membrane, which is then fixed either with fibrin (Tissucol®, Baxter) or with sutures. Aftercare occurs in the same way as with ACT (i.e. six weeks using crutches). Advances of this technology are: only one matrix-induced chondrogenesis (MIC) intervention, good stabilisation of the blood clots, extensive defect filling, and reduced costs. In a prospective multi-centre study, the method has produced hopeful clinical results. In the first comparative animal study between autologous matrix-induced chondrogenesis (AMIC) and ACT, ACT was a histological consideration.
from the cartilage tissue in the lab and grown in culture as de-differentiated chondrocytes. These cells are very similar to stem cells. For the cultivation of the cells, optimised cultural conditions like standardised protein levels, growth factors, and the control of metabolic capacity are required.

Studies prove that the number of the cell doublings (<4 passages) in the culture influences the later formation of high-quality cartilage in the defect. In contrast to differentiated, de-differentiated matrix-engaged chondrocytes, expressed surface receptors similar to stem cells whilst in culture.

After the achievement of purpose-cell numbers, dependent on defect and fulfillment of the exit high-class criteria (cell number, vitality, synthesis of specific cartilage molecules and exclusion of infection), the cells are transported to the clinic in a cell vial. In a second intervention, the cartilage damage is cut and the destroyed cartilage is removed from the bone. Opening of the bone marrow should be avoided in order to achieve high-quality repair of the cartilage.

An aluminium impression is made and used for the cutting of the periosteal flap or a collagen membrane. The fitted membrane is watered with salt-solution and is sutured with the rough side to the bone using either 6-0 polydioxanone (PDS) or Vicryl sutures (see Figure 2). A second incision in the tibia front is necessary to harvest the periosteal flap in contrast to use of a collagen membrane. After superficial fibrin sealing and a density check, the cells are injected with a plastic catheter under the periosteal flap or collagen membrane. The injected cells attach on the subchondrale bone plate and form a first cell layer. The synthesis ability of the chondrocytes fills the cartilage defect with high-quality repair cartilage. The final structure of the repair cartilage is observed approximately 18 months after implantation. An especially large significance is placed on a standardised post-surgical rehabilitation. Mobilisation should be carried out for six to eight weeks with feed contact. The use of a continuous passive motion (CPM) machine plays an important role during the first cartilage formation. With a follow-up period of between two and 12 years, clinical studies observed between 70% and 90% ‘good’ and ‘very good’ results with the use of a periosteal flap. The resulting repair cartilage distinguishes itself by having good biomechanical qualities. A disadvantage of the method, proved in 5–25% of the cases, is the symptomatic hypertrophy of the periosteal flap. This bi-layer membrane has a smooth outside and good mechanical firmness, as well as a barrier function to other establishing cells (synovia-cells) in the joint. The porous nature stimulates the cells into the re-differentiation and production of matrix molecules specific for cartilage. In our comparative clinical study, we observed ‘very good’ to ‘good’ clinical results with 163 knee-joint patients more than three years post-operatively (see Figure 2b).

**Modifications of ACT**

The last time ACT was modified was with combinations of different carrier materials (MACI®, Gel-MACI). The cells cultivated from the carrier material changed their differentiation behaviour (differentiated cells). From determining the meaning of the degradation of the bio-material, construction of the tissue is co-ordinated. In the area of tissue engineering, the combination of cells and bio-materials is extremely complicated and not yet adequately examined. Good tissue regeneration and catastrophic long-term effects are sometimes closely related. Currently, it is unclear whether these modifications, introduced only to bring relief to the operating procedure and not for the improvement of the clinical results, will bring equally good long-term results.

* A longer version of this article containing references can be found in the Reference Section on the website supporting this briefing (www.touchbriefings.com).
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