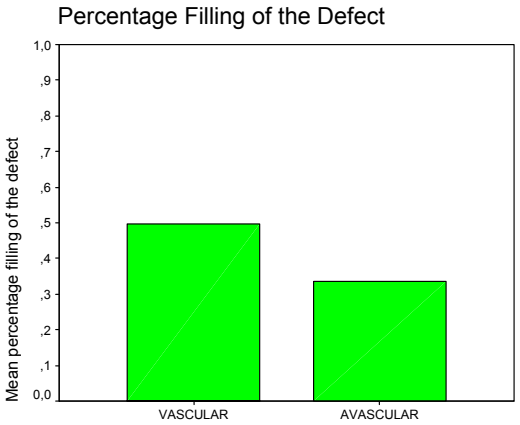
Asbjørn Årøen[1,3,4], asben@online.no;
Stig Heir [1,3,5] Sverre Løken [3,6], Finn Reinholt [2] , Lars Engebretsen [3,6]
1) Institute of Surgical Research, Rikshospitalet, Oslo, Norway, 2) Department of Pathology, Rikshospitalet, Norway,
3) Oslo Sports Trauma Center, Norwegian University of Sport & Physical Education, Oslo, Norway,
4) The University hospital of Akershus, Lørenskog, Norway, 5) Martina Hansen Hospital, Bærum, Norway,
6) Oslo Orthopaedic University Clinic, Oslo, Norway

# An Experimental Study of Vascular versus Avascular Microenvironment to Induce Cartilage Healing

**Introduction** The microenvironment in the cartilage defect might be a key factor in order to achieve a functional repair tissue. This long- term experimental study evaluates the effects of the cartilage defect as a bioactive chamber with and without access to the bone marrow.

**Experimental Method** In seventeen New Zealand rabbits 22 weeks of age, a defect was induced in patella of both knees at time zero. After 2 weeks the defects were repaired. Thirty-six weeks after the repair the animals were sacrificed and the repair tissue evaluated. Preoperatively at each of the three time points a wash out sample from the joint was collected by installing 2cc NaCl into the joint, doing 50 cycles of full ROM before the sample was aspirated. The surgical procedure included a bilateral arthrotomia using a biopsipunch (φ = 4 mm) to induce the cartilage lesion. Microsurgery instruments and a Zeiss stereomicroscope were used to secure removal of all the cartilage tissue in the defect down to the subchondral bone plate. At the rearthrotomia two weeks later, one of the knees was randomized to have 4 drill holes (φ = 0,06 mm) drilled by hand in the defect to make access to the subchondral bone marrow, thus creating a vascular chamber. The defect in the other knee remained avascular. A periosteum flap was harvested from the anteriomedial part of tibia and placed at the defect with the cambium layer facing down and sutured with four 9.0 sutures to the edge of the defect and glued with Tissel glue ®. All rabbits were observed for one week in their cages while antibiotics and analgesics were administered. After one week the rabbits were allowed to move freely on a 10-$m^2$ floor. Synovial fluid was analyzed proteoglycan concentration using standard ELISA technique. So far eight animals have been prepared for histological evaluation. Four slices from each patella were evaluated according to the filling of defect. Additionally the percentage of attachment to subchondral bone in the defect was measured. Statistical analyses were performed with Wilcoxon Signed Rank Test.

**Results** Macroscopically a soft gelatinous repair tissue was observed in all experimental defects though none were completely filled. Histological the repair tissue is classified as fibrous tissue. Penetration and access to patellar bone marrow was observed in all samples. The vascular side showed a percentage of filling of 49 % ± 14 % while the non-vascular side was evaluated to 34 % ± 24 %, p = 0,12. Interface binding of the repair tissue to the subchondral bone was 38 % ± 26 % at the vascular side




and 24 % ± 26 % at the avascular side, p = 0,33. The proteoglycan analyses showed a slight increase in both groups at two weeks but returned to the preexperimental level at sacrifice (age 60 weeks). All knees showed full range of motion and patella femoral arthritis was observed in two animals only.

**Discussion** Previously the avascular chamber using periosteum as a membrane has been investigated and similar results has been found (1). This study shows that such a bioactive chamber supplied with bone marrow elements provided through minor penetration of subchondral bone plate is not sufficient to restore a functional cartilage tissue.

**Conclusion** No significant difference concerning macroscopically, histological and synovial fluid analysis was found between vascular and avascular microenvironment in periosteum transplantation in order to induce cartilage healing.

**Reference**

1. Brittberg M, Nilsson A, Lindahl A, Ohlsson C, Peterson L: Rabbit articular cartilage defects treated with autologous cultured chondrocytes. *Clin Orthop* : 270-283., 1996

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