

Clinical Sheet

ONE-STEP REPAIR OF FOCAL CHONDRAL KNEE LESIONS

Treating cartilage defects of the knee with microfractures, equine collagen matrix and bone marrow concentrate from iliac crest.



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Bone marrow stimulation is one of the first reparation techniques developed for surgical treatment of chondral knee injuries. It involves performing multiple perforations of the subchondral bone, which cause it to bleed and result in the subsequent release of mesenchymal stem cells and growth factors.

The AMIC technique (Autologous Matrix Induced Chondrogenesis) is an evolution of this method that associates the execution of microfractures according to Steadman with placement of a collagen matrix, in order to contain cells and factors in the lesion site, preventing their dispersion in the intra-articular space¹. To further improve the regenerative potential of the treated lesion, in the papers presented herein, the collagen matrix was imbibed with autologous bone marrow concentrate from the iliac crest, rich in mesenchymal stem cells, which supports the formation of new cartilage tissue and functional joint recovery.

1. Behrens P. *Arthroskopie* 18, 193-197 (2005).

Materials

The MeRG collagen membrane (Bioteck, Italy) was used to cover the defect. The membrane has a smooth and a rough side, due to the three-dimensional texture of the collagen fibrils it consists of. The rough side is the one that is laid over the defect to be treated, in order to maximize the contact surface between membrane and lesion.

Prior to application, the membrane must be adapted to the shape of the defect with the aid of a sterile

surgical template, provided in the package, then quickly hydrated with a few drops of saline. When in contact with blood, the membrane features adhesive properties that make it easier to position. Stabilization on the receiving tissue is performed with fibrin glue.

The membrane is sized 50 x 50 mm and it is spontaneously resorbed in 60-90 days after grafting.



Fig. 1 – Preoperative magnetic resonance in sagittal section. The arrow highlights signal inconsistency in the front area of the medial femoral condyle.



Fig. 2 – Diagnostic arthroscopy is performed with access through the anteromedial and anterolateral portal. It allows the chondral lesion to be identified and surgical indication to be ascertained.



Fig. 3 – Using a syringe and a 2.5 mm Jamshidi type needle, 60 ml of bone marrow are aspirated from the iliac crest then concentrated with the appropriate kit (MarrowStim Concentration kit, Biomet) until obtaining a final volume of 3-4 ml.

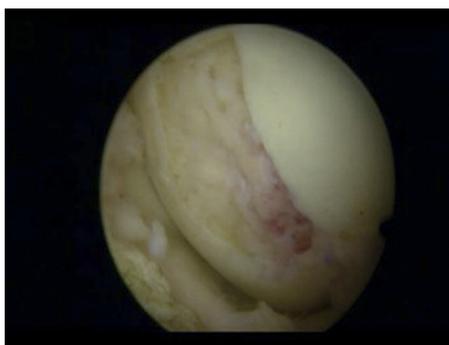


Fig. 4 – Lesion debridement is performed and the micro-fractures are executed spaced at 2-3 mm. The greater dimensions of the lesion are measured using a Kirschner wire.

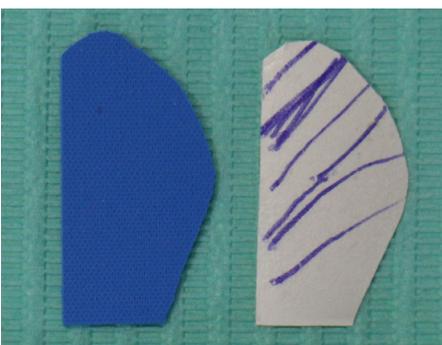


Fig. 5 – The dimensions of the lesion are marked on a surgical template, which is cut out and used as model to mold the MeRG membrane. A skin-marker pencil is used to mark lines with an asymmetrical pattern for ease of orientation during intraarticular placement.



Fig. 6 – The membrane is soaked in and allowed to imbibe the bone marrow concentrate.

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Results

The sheet sums up the clinical and histologic results obtained in surgical treatment of focal chondral defects by means of microfractures and MeRG collagen scaffold enriched with bone marrow concentrate².

This is a retrospective study published in 2015 on *The Knee* (Elsevier) to complement the preliminary data on the same surgical technique collected and published in 2011 and 2012.^{3,4}

The case series involved 9 patients aged between 28 and 53, suffering from chondral lesions in the medial (n=7) and lateral femoral condyle (n=2). The lesions were grade III or IV according to Outerbridge classification and average size was 2.4 cm² (range: 1.8-3 cm²).

The average patient follow-up was 29 months (range: 14-51 months). One year after surgery, four patients underwent control arthroscopy with a biopsy taken from the regenerated site. At the last follow-up, the clinical scores were measured with regards to Lysholm, IKDC (International Knee

Documentation Committee), VAS (Visual Analog Scale) and Tegner classifications.

According to histologic classification ICRS II the average quality of the four bone biopsies was 64 (Standard Deviation, SD: 13) with an average score of tissue morphology of 63 (DS:19).

The biopsies, stained with Safranin O, showed the formation of hyaline cartilage in one case (Picture 10), intermediate composition in two cases and fibrocartilage in the remaining case.

The treatment resulted in a statistically significant improvement of all the measured clinical scores (Picture 11). Post-operative MRI (available for three patients) showed the outcome of chondral regeneration at 12-month follow-up (Picture 12).

2. Enea, D. et al. *The Knee* 22, 30–35 (2015).

3. Gigante, A. et al. *Int. J. Immunopathol. Pharmacol.* 24, 69–72 (2011).

4. Gigante, A., et al. *Arthrosc. Tech.* 1, e175-180 (2012).



Fig. 7 – After aspirating the fluid from the joint cavity, a 1:10 mixture of fibrin glue and bone marrow concentrate is placed on the lesion.



Fig. 8 – Positioning of the MeRG collagen membrane on the defect.



Fig. 9 – An additional amount of 2-3 ml fibrin glue and bone marrow concentrate is placed on the membrane and allowed to coagulate for a couple of minutes.

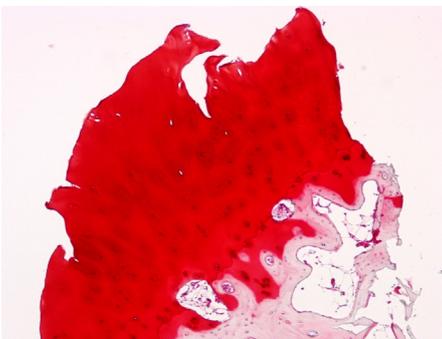


Fig. 10 – Biopsy sample taken 12 months after the procedure and stained with Safranin O. The regenerated tissue corresponds to hyaline cartilage.

Patient	Age	FU (mesi)	Lysholm pre	Lysholm post	IKDC pre	IKDC post	VAS pre	VAS post
1	52	32	67	90	51	86	7	3
2	48	32	40	96	38	91	7	2
3	36	28	67	99	57	95	7	3
4	53	28	70	78	61	72	9	6
5	41	35	40	94	32	84	9	0
6	48	28	51	100	39	98	8	0
7	35	14	75	68	63	61	6	8
8	48	14	50	81	54	78	8	3
9	28	51	59	82	49	78	7	2
Mean	43,2	29,1	57,7	87,6	49,3	82,6	7,6	3,0
SD	8,6	11,1	13,0	10,9	10,9	11,7	1,0	2,6

Fig. 11 – The pre and post surgery functional scores according to Lysholm, IKDC (International Knee Documentation Committee) and VAS (Visual Analog Scale)

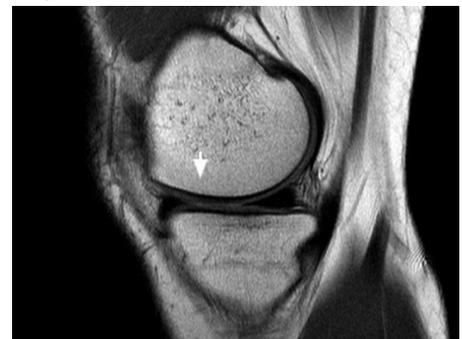


Fig. 12 – Post-operative magnetic resonance imaging in sagittal section 12 months after surgery. Notice the excellent defect filling and signal consistency at the repaired region (white arrow).



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