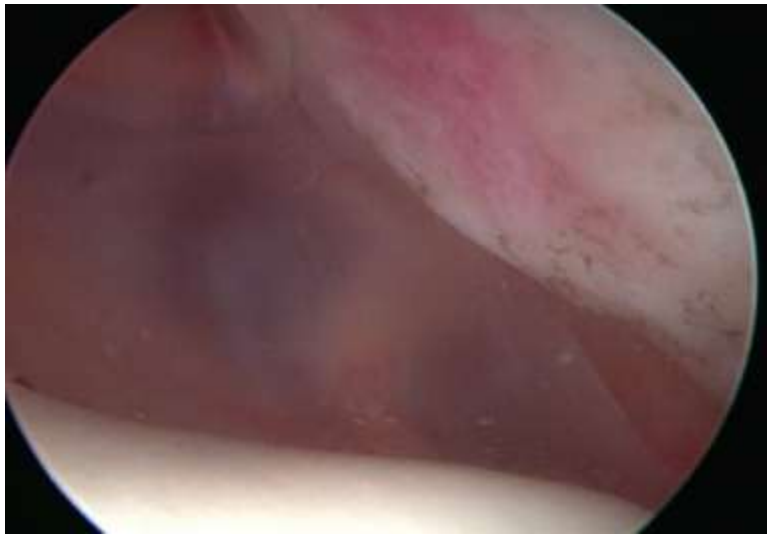
SURGICAL TREATMENT OF EARLY OSTEOARTHRITS OF THE KNEE PRIOR TO ARTHROPLASTY



Dr. Andreas Panagopoulos, MD, Ph.D.

Assistant Professor in Orthopedics, Medical School, Patras University

Sports Orthopedic Surgeon, Patras University Hospital, GR

Definition

OA is a heterogeneous group of conditions that leads to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone at the joint margins.

Definition

Although OA is a disease of the whole joint, the primary change is loss of articular cartilage.

Bony remodelling, osteophyte formation and synovial, capsular, ligamentous and muscular changes are secondary

Incidence

Between 1991 and 2000, the number of primary total hip replacements being undertaken in England increased by 18%, and the number of primary knee replacements more than doubled. **Revision hip and knee arthroplasty** increased by 154% and 300%, respectively

OsteoArthritis and Cartilage (2007) 15, 981–1000

doi:10.1016/j.joca.2007.06.014

Osteoarthritis and Cartilage

International Cartilage Repair Society

OARSI OSTEOARTHRITIS RESEARCH SOCIETY INTERNATIONAL

OARSI recommendations for the management of hip and knee osteoarthritis, Part I: Critical appraisal of existing treatment guidelines and systematic review of current research evidence

W. Zhang Ph.D., R. W. Moskowitz M.D., G. Nuki M.B., F.R.C.P.*, S. Abramson M.D., R. D. Altman M.D., N. Arden M.Sc., M.R.C.P., S. Bierma-Zeinstra Ph.D., K. D. Brandt M.D., P. Croft M.D., M. Doherty M.D., F.R.C.P., M. Dougados M.D., M. Hochberg M.D., D. J. Hunter M.B.B.S., Ph.D., K. Kwoh M.D., L. S. Lohmander M.D., Ph.D. and P. Tugwell M.D.
University of Edinburgh, Osteoarticular Research Group, The Queen's Medical Research Institute, 47 Little France Crescent, Edinburgh EH16 4TJ, United Kingdom

Twenty-three guidelines have been developed for the treatment of hip and/or knee OA, based on opinion alone, research evidence or both.

Although this suggests that a core set of recommendations for treatment exists, critical appraisal shows that the overall quality of existing guidelines is sub-optimal, and consensus recommendations are not always supported by the best available evidence.

OsteoArthritis and Cartilage (2007) 15, 981–1000

doi:10.1016/j.joca.2007.06.014

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University of Edinburgh, Osteoarticular Research Group, The Queen's Medical Research Institute, 47 Little France Crescent, Edinburgh EH16 4TJ, United Kingdom

Non – pharmagological

acupuncture
manual therapy
physical therapy
devices (orthotics)
education
self-management
weight loss
TENS
thermal modalities
nutraceuticals (chondroitin)

Pharmacological

Acetaminophen
Topical NSAIDs
Cox-2 inhibitors
Opioids
Glucosamine
Chondroitin sulphate
Diacerhein
molecular HA (Hylan)

Surgical

Arthroscopic lavage Knee
Arthroscopic debridement
Patellar resurfacing Knee
Osteotomy Knee
Joint distraction
TJR Both
Knee aspiration
Knee fusion

THE JOURNAL OF BONE & JOINT SURGERY (BJ)

■ ASPECTS OF CURRENT MANAGEMENT

The assessment of early osteoarthritis

T. C. B. Pollard,
S. E. Gwilym,
A. J. Carr

From the Nuffield Orthopaedic Centre, Oxford, England

The first abnormality seen in osteoarthritic cartilage is **oedema**, which is secondary to disruption of the macromolecular framework and degradation of aggrecan

Table I. Changes in articular cartilage after injury, in osteoarthritis and with ageing[3]

Feature	Reversible injury	Oestoarthritis	Ageing
Cartilage mass	Hypertrophy	Hypertrophy, erosion	No change
Cartilage topographic distribution	Focal	Focal, heterogenous	General, all layers
Cartilage water	Oedema	Oedema	Dehydration
Cartilage collagen	Reversible deformation	Degradation	Increased advanced glycation end-products
Cartilage proteoglycan	Reversible depletion	Irreversible depletion	Reduced synthesis
Cartilage matrix degeneration products	Resorption	Accumulative, collagen, proteoglycan etc.	Accumulative: oxidation, glycation, amyloid
Cell activity	Reversibly increased	Increased activity and proliferation	Reduced
Synovium	Mild focal superficial inflammation	Mild focal superficial inflammation	Atrophy
Bone	No change	Subchondral remodelling	Osteopaenia

THE JOURNAL OF BONE & JOINT SURGERY (Br)

■ ASPECTS OF CURRENT MANAGEMENT

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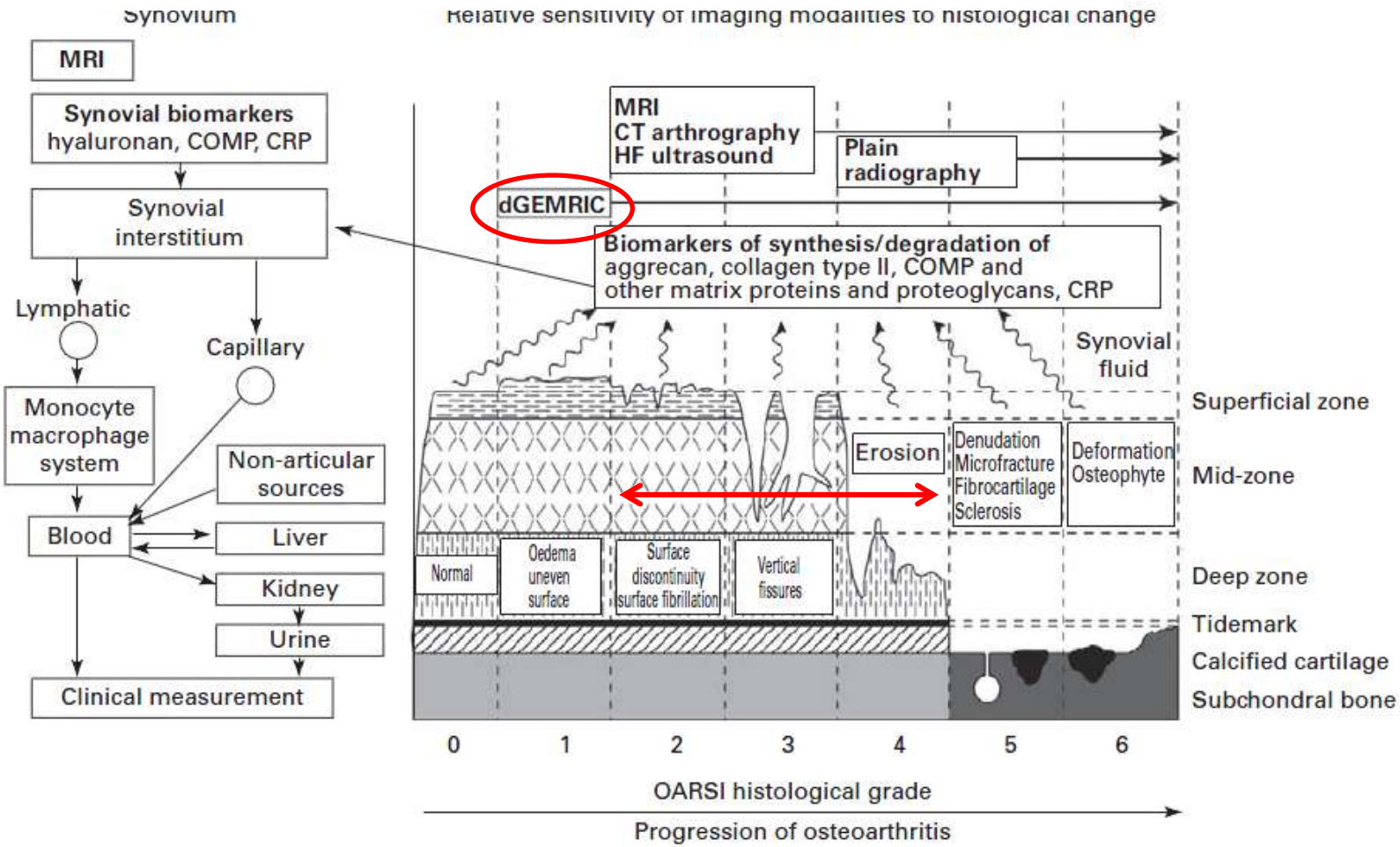


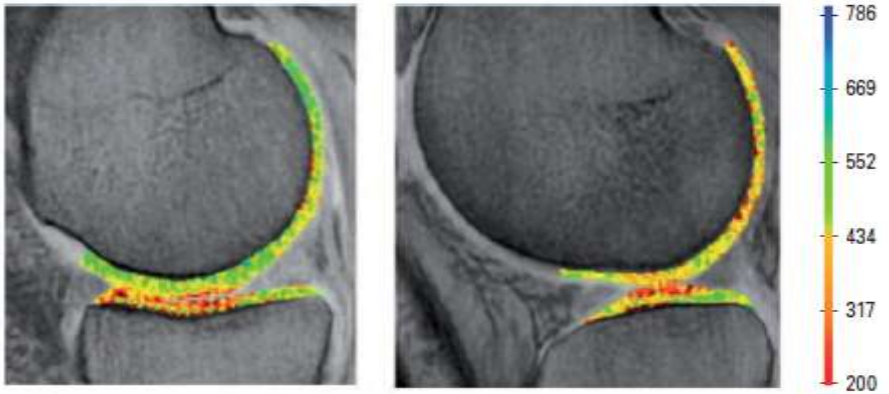
Review Article

Advances in Magnetic Resonance Imaging of Articular Cartilage

Laith M. Jazrawi, MD
Michael J. Alaia, MD
Gregory Chang, MD
Erin F. FitzGerald, MD
Michael P. Recht, MD

J Am Acad Orthop Surg 2011;19: 420-429

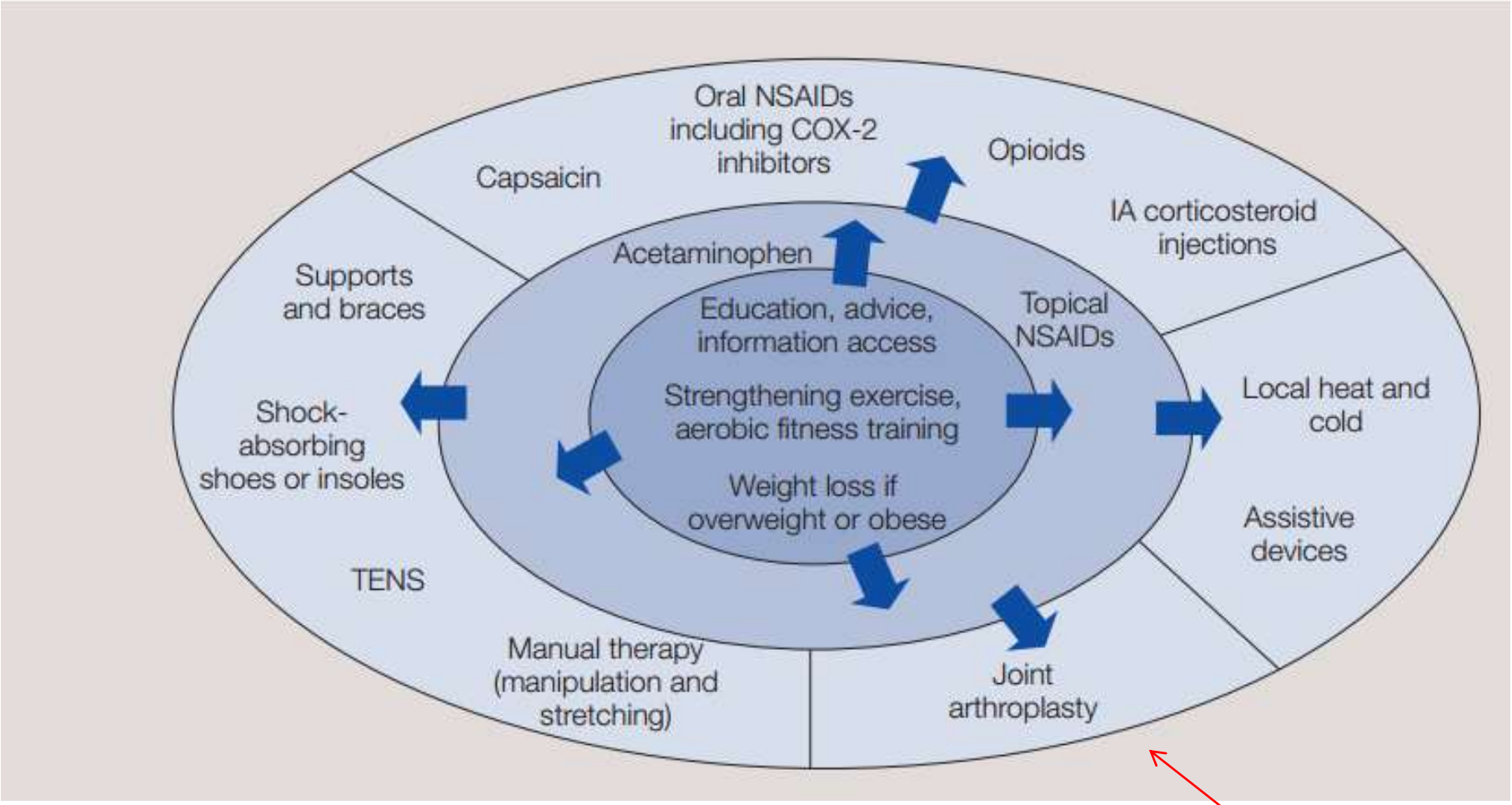
delayed Gadolinium-Enhanced MRI of Cartilage (dGEMRIC)



Gadopentetate dimeglumine disperses inversely with the amount of GAG in cartilage; thus, normal articular cartilage should have a low concentration, and damaged cartilage should have a high concentration

The NICE treatment algorithm for knee OA

Reprinted with permission from NICE.
Osteoarthritis: the care and management of osteoarthritis in adults. London: NICE, 2008.



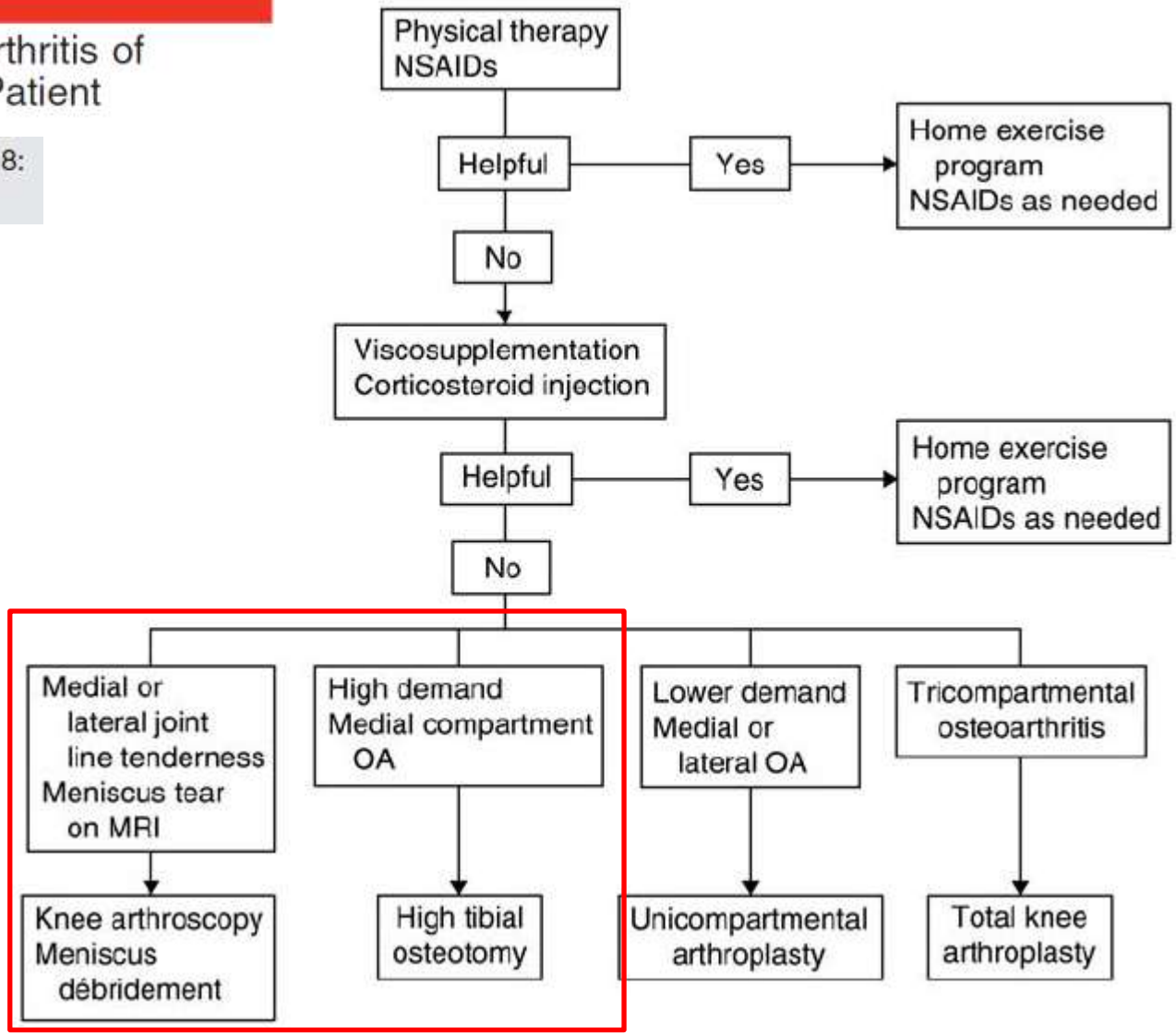
Treatment algorithm

Review Article

Management of Osteoarthritis of the Knee in the Active Patient

J Am Acad Orthop Surg 2010;18: 406-416

Brian T. Feeley, MD
Robert A. Gallo, MD
Seth Sherman, MD
Riley J. Williams, MD



Knee Surg Sports Traumatol Arthrosc (2012) 20:450–466
DOI 10.1007/s00167-011-1780-x

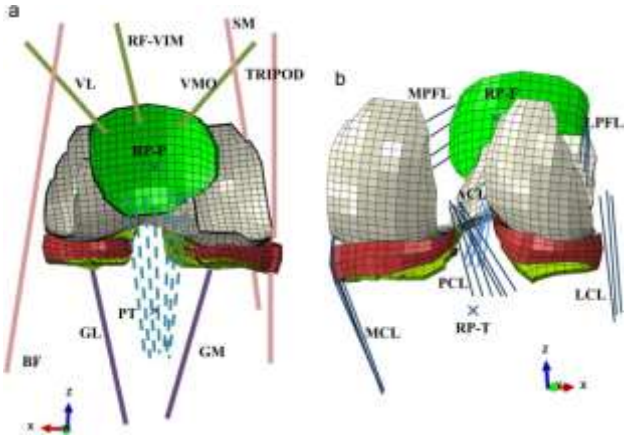
KNEE

Surgical treatment for early osteoarthritis. Part I: cartilage repair procedures

A. H. Gomoll · G. Filardo · L. de Girolamo · J. Esprequeira-Mendes · M. Marcacci · W. G. Rodkey · R. J. Steadman · S. Zaffagnini · E. Kon

Treatment options

1. Arthroscopic lavage & debridement
2. Bone marrow stimulation
3. Cell-based therapy
4. Osteochondral autograft transfer
5. Scaffolds



Tibiofemoral compartment #
Patellofemoral compartment

Knee Surg Sports Traumatol Arthrosc (2012) 20:468–486
DOI 10.1007/s00167-011-1714-7

KNEE

Surgical treatment for early osteoarthritis. Part II: allografts and concurrent procedures

A. H. Gomoll · G. Filardo · F. K. Almqvist · W. D. Bugbee · M. Jelic · J. C. Monllau · G. Puddu · W. G. Rodkey · P. Verdonk · R. Verdonk · S. Zaffagnini · M. Marcacci

Treatment options

1. Osteochondral allografts
2. Allogenic cartilage grafts
3. Meniscal scaffolds and allograft transplantation
4. Osteotomy

Arthroscopic lavage

Osteoarthritis and Cartilage (2000) **8**, 412–418
© 2000 OsteoArthritis Research Society International
doi:10.1053/joca.2000.0316, available online at http://www.idealibrary.com on IDEAL®
1063–4584/00/060412+07 $35.00/0

Osteoarthritis and Cartilage
Journal of the OsteoArthritis Research Society International

OARSI OSTEOARTHRITIS RESEARCH SOCIETY INTERNATIONAL

Visually-guided irrigation in patients with early knee osteoarthritis: a multicenter randomized, controlled trial

K. C. Kalunian*, L. W. Moreland†, D. J. Klashman*, P. H. Brion*, A. L. Concoff*, S. Myers‡, R. Singh*, R. W. Ike§, L. L. Seeger*, E. Rich‖ and M. L. Skovron¶

Table I
Baseline patient characteristics

Characteristic	Minimal irrigation	Full irrigation	*P*-value
No. of patients	49	41	
Mean age (years)	58.3 (range 40–85)	60.9 (range 41–88)	0.39
Gender:			
Female	26	22	
Male	23	19	
Race:			
Caucasian	40	32	0.59
Non-Caucasian	9	9	
Symptom duration (months)	34.4 (range 2–120)	30.0 (range 2–120)	0.99
Knee swelling*	0.45 (range 0–2)	0.78 (range 0–2)	0.01
Knee tenderness*	0.60 (range 0–2)	0.85 (range 0–2)	0.07
Radiographic score (total)†	4.44 (rang 0–12)	4.00 (range 0–10)	0.66
Cartilage damage score	37.8 (range 3–91.3)	44.8 (range 5–118.4)	0.25
Inflammation score	10.8 (range 0–25.8)	10.7 (range 0–36.8)	0.94
Patient assessment (VAS)	3.63 (range 0–9.2)	3.67 (range 0–7.9)	0.75
Aggregate WOMAC	40.67 (range 8–86)	41.09 (range 1–75)	0.64

*Physician ratings on a 4-point ordinal scale

2 groups (3000ml) instead (250ml) of fluid irrigation

Beneficial only in patients with early OA and crystals

Arthroscopic lavage

RHEUMATOLOGY

Rheumatology 2010;49:334–340
doi:10.1093/rheumatology/kep382
Advance Access publication 2 December 2009

Original article

Efficacy of joint lavage in knee osteoarthritis: meta-analysis of randomized controlled studies

Jérome Avouac[1], Eric Vicaut[2], Thomas Bardin[1] and Pascal Richette[1]

Rheumatology key messages

- Joint lavage is no more efficacious than placebo at 3 months on pain and function.
- Combination of joint lavage and corticosteroid injection does provide additional benefit.

Arthroscopic lavage & debridement

Journal of Orthopaedic Surgery and Research

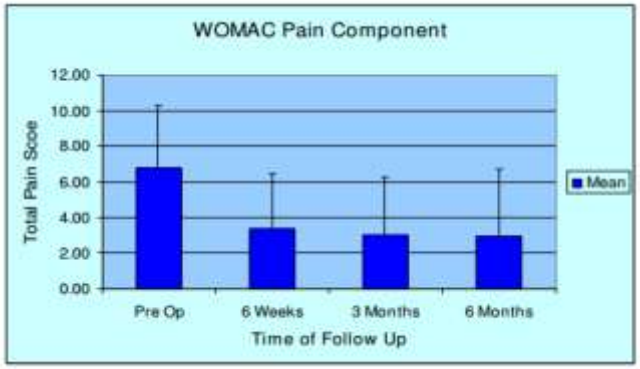
BioMed Central

Research article

Open Access

Arthroscopic debridement of the osteoarthritic knee combined with hyaluronic acid (Orthovisc®) treatment: A case series and review of the literature

Xinning Li*, Agam Shah, Patricia Franklin, Renee Merolli, Jill Bradley and Brian Busconi



The combination of both procedures show efficacy in reducing WOMAC pain scores and improving SF- 36 PCS scores over a six month period.

Arthroscopic lavage & debridement

EVIDENCE-BASED ORTHOPAEDICS

ARTHROSCOPIC LAVAGE OR DÉBRIDEMENT DID NOT REDUCE PAIN MORE THAN PLACEBO DID IN PATIENTS WITH OSTEOARTHRITIS

MOSELEY JB, O'MALLEY K, PETERSEN NJ, MENKE TJ, BRODY BA, KUYKENDALL DH, HOLLINGSWORTH JC, ASHTON CM, WRAY NP. A CONTROLLED TRIAL OF ARTHROSCOPIC SURGERY FOR OSTEOARTHRITIS OF THE KNEE. N ENGL J MED. 2002 JUL 11;347:81-8.

Arthroscopic débridement or arthroscopic lavage vs placebo for osteoarthritis of the knee

Outcome*	Mean Score			Mean Difference† (95% CI)
	Débridement	Lavage	Placebo	
Pain at 1 y				
Débridement vs placebo	51.7		48.9	2.8 (–5.9 to 11.5)
Lavage vs placebo		54.8	48.9	5.9 (–2.0 to 13.8)
Pain at 2 y				
Débridement vs placebo	51.4		51.6	0.2 (–8.8 to 9.2)
Lavage vs placebo		53.7	51.6	2.1 (–6.9 to 11.1)

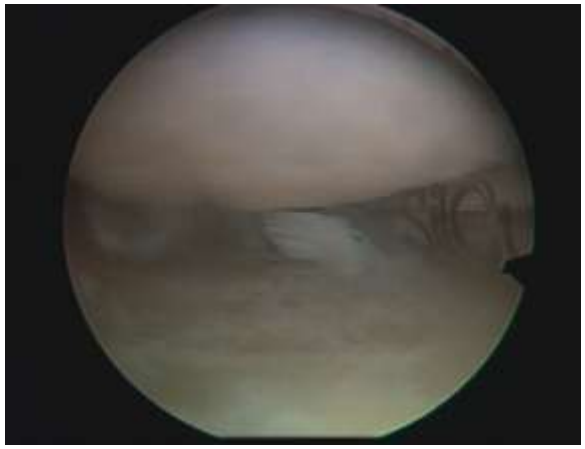
*Assessed according to the Knee-Specific Pain Scale (scores ranged from 0 to 100 [most severe]). †All mean differences were not significant, and they were calculated, as were the confidence intervals (CI), from data in the article.

In patients with osteoarthritis of the knee, neither arthroscopic lavage nor arthroscopic débridement was better than a placebo procedure for reducing pain or improving function.

The Role of Arthroscopy in Treating Osteoarthritis of the Knee in the Older Patient

Stephen M. Howell, MD

Orthopedics
September 2010 - Volume 33 · Issue 9:
DOI:



No evidence that removal of loose debris, cartilage flaps, torn meniscal fragments, etc have any pain relief or functional benefit in patients that have joint space narrowing on standing radiographs.

3 indications only:

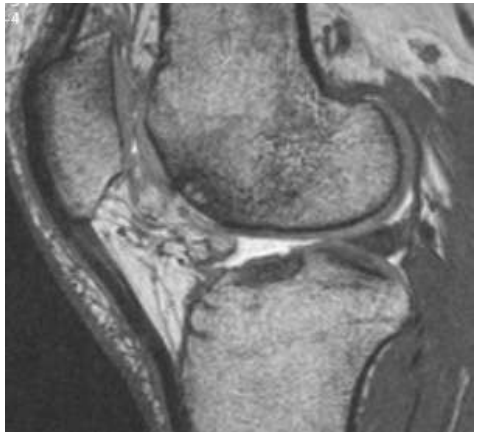
- removal of loose body
- meniscectomy

} True mechanical symptoms

- anterior osteophyte (to improve extension)

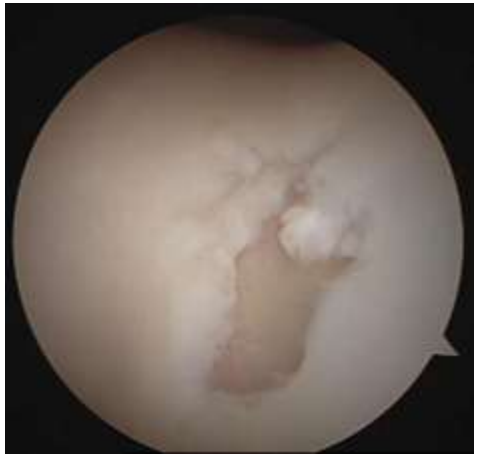
Bone marrow stimulation

Symptomatic, focal high-grade chondral lesions of the weightbearing femoral condyles, trochlea, and patella in active patients



Incidental cartilage lesions

A defect size of <4 cm^2



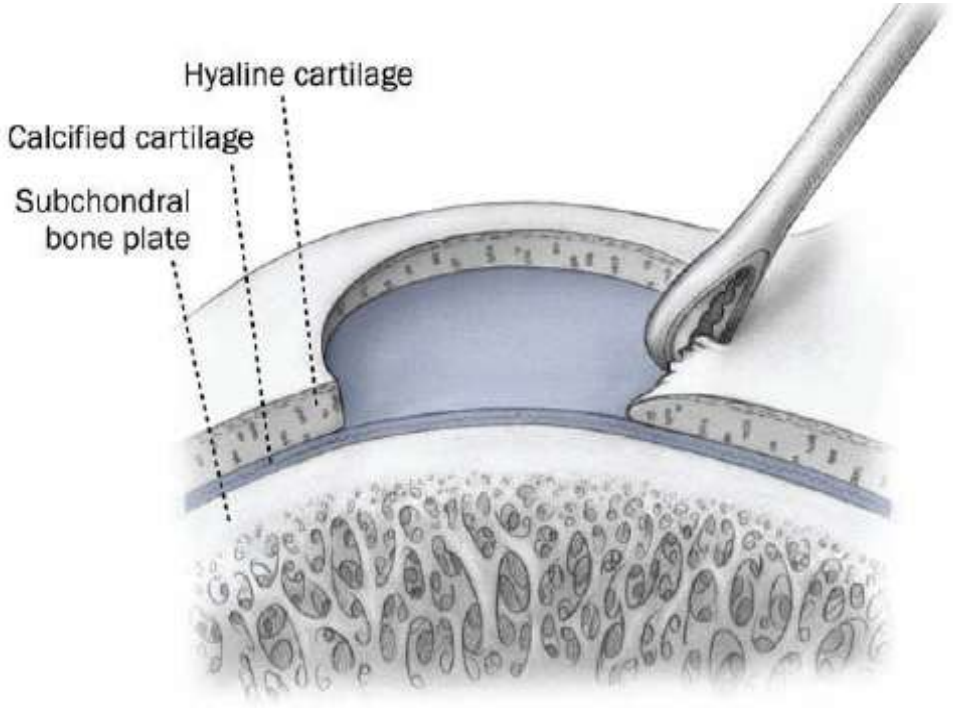
A short preoperative duration of symptoms (optimally, less than 12 months)

Optimal patient age should be < 45 years-old

Mithoefer K, et al, JBJS 2006

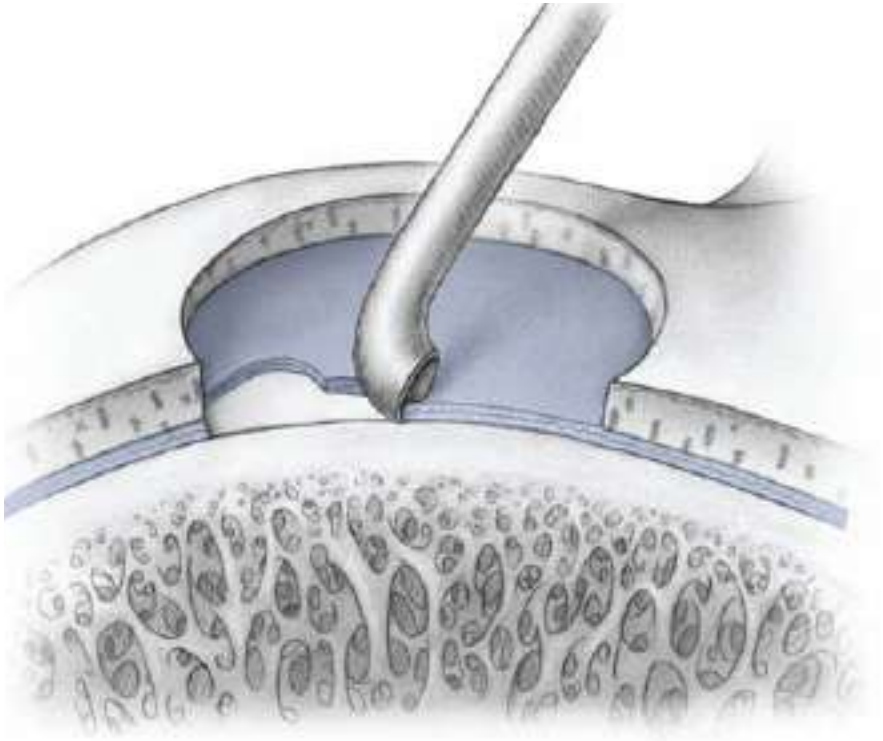
Surgical technique

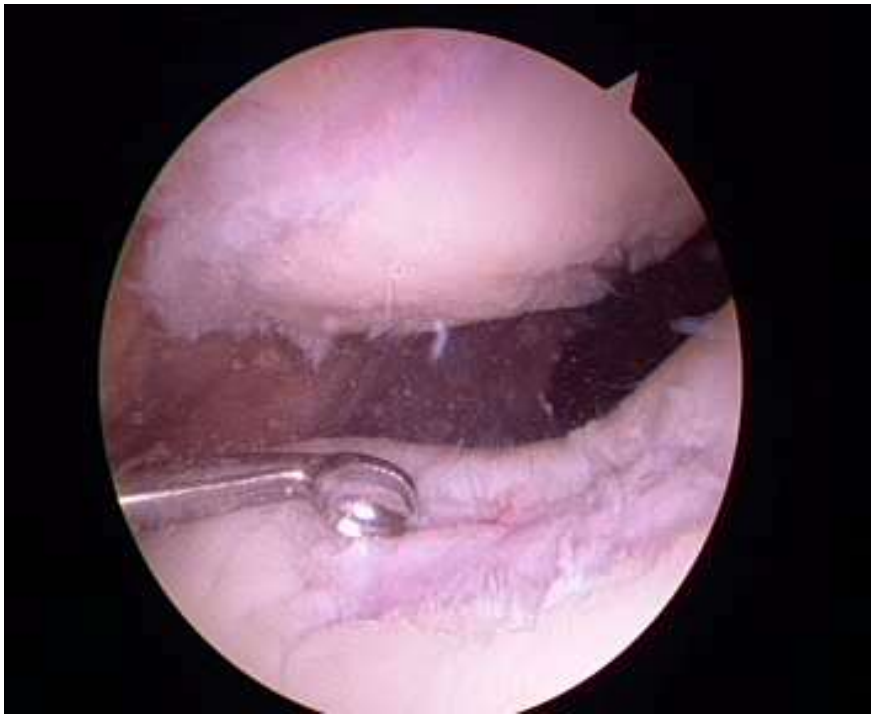
- Debridement, with use of an arthroscopic shaver, of any loose cartilage flaps to create a stable peripheral cartilage margin



Surgical technique

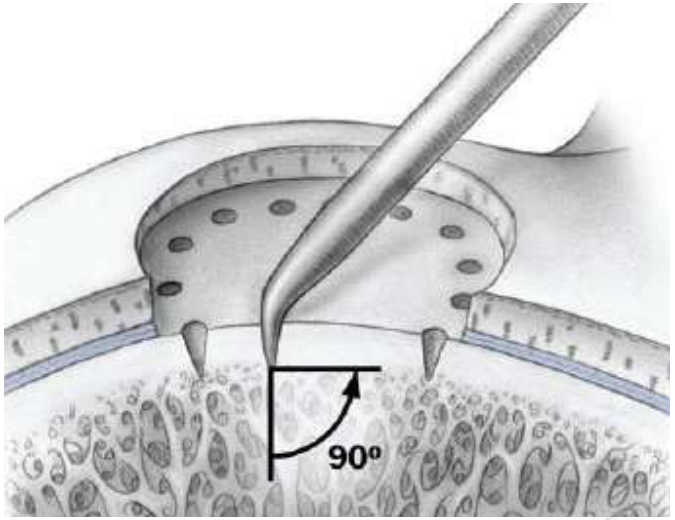
- débridement of the calcified cartilage layer with use of a curet to provide manual feedback control

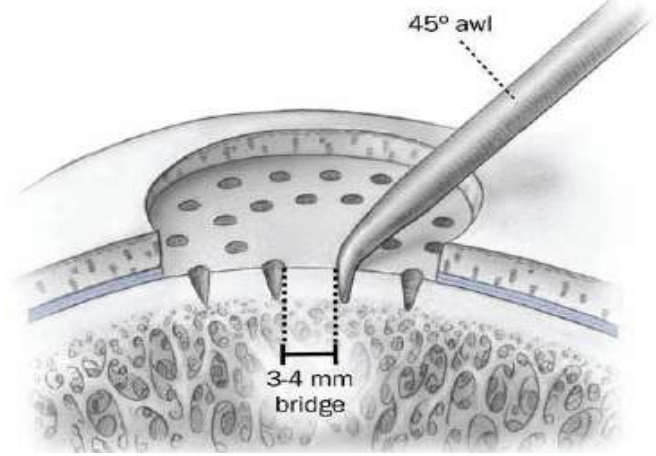


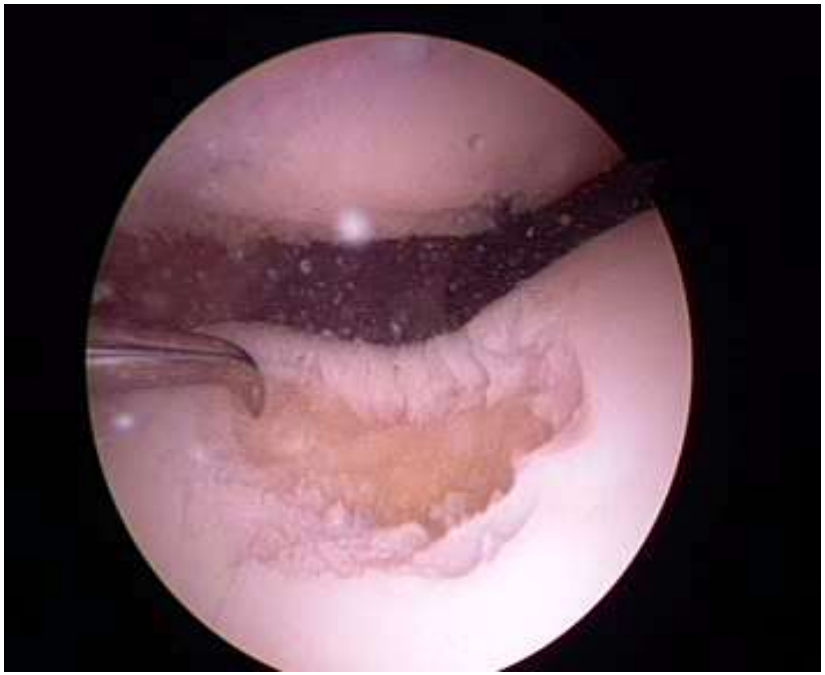


Surgical technique

- the adequate depth of subchondral bone penetration and width of osseous bridges between the individual microfracture holes

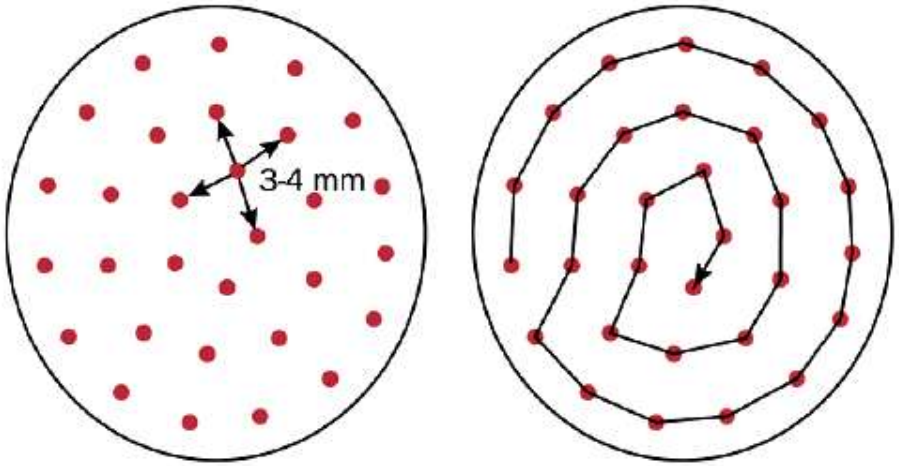


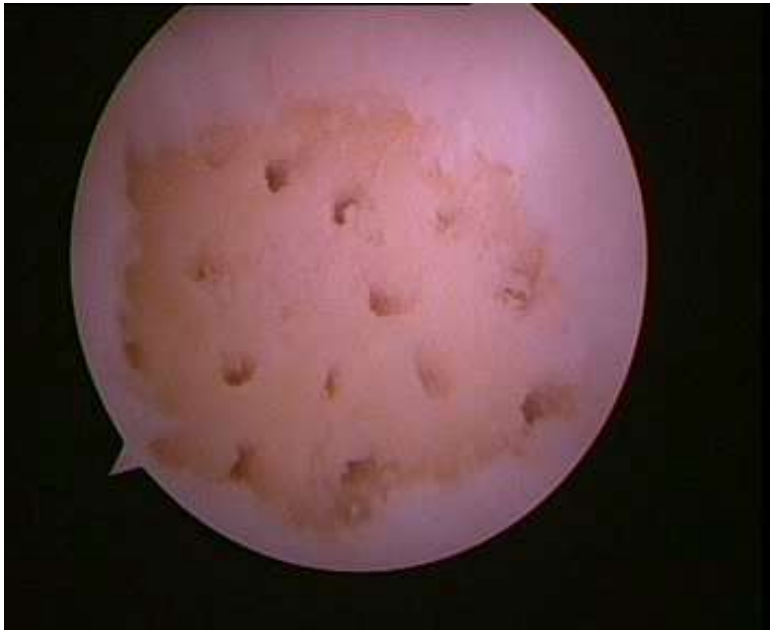




Surgical technique

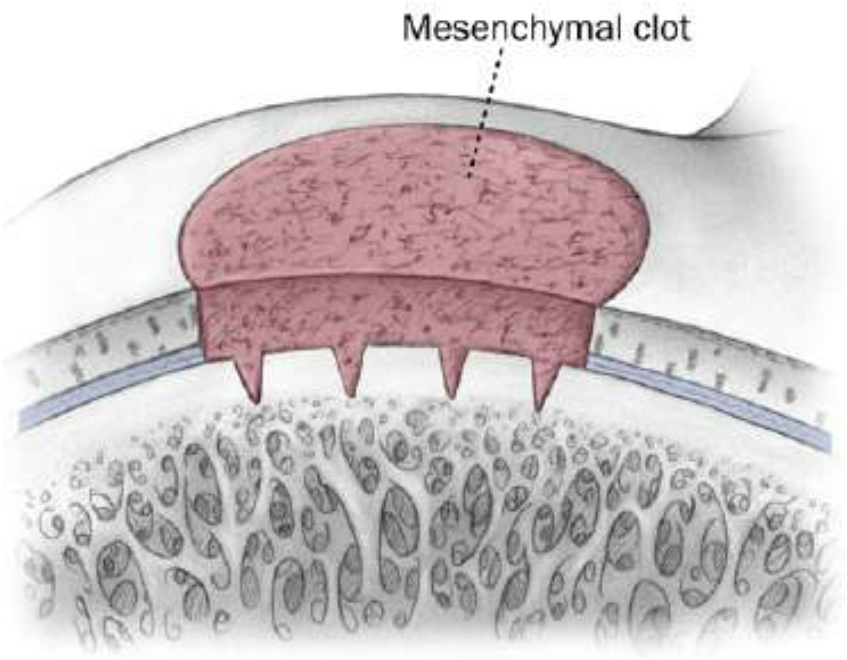
- the adequate depth of subchondral bone penetration and width of osseous bridges between the individual microfracture holes





Surgical technique

- adequacy of the microfractures by noting the release of fat droplets and blood from the individual holes

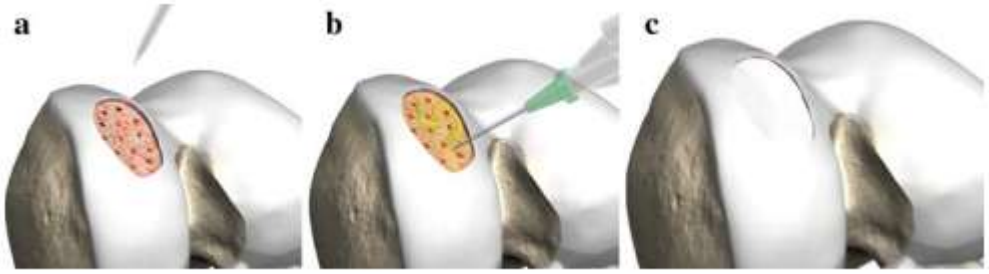


Knee Surg Sports Traumatol Arthrosc (2011) 19:1316–1319
DOI 10.1007/s00167-010-1356-1

KNEE

The treatment of chondral and osteochondral defects of the knee with autologous matrix-induced chondrogenesis (AMIC): method description and recent developments

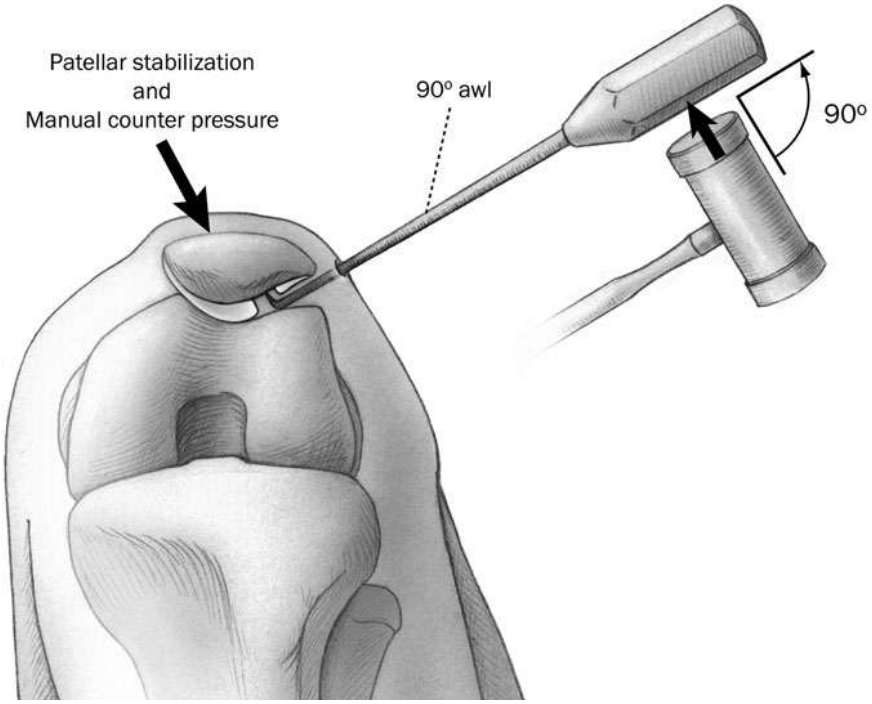
Jan Philipp Benthien · Peter Behrens

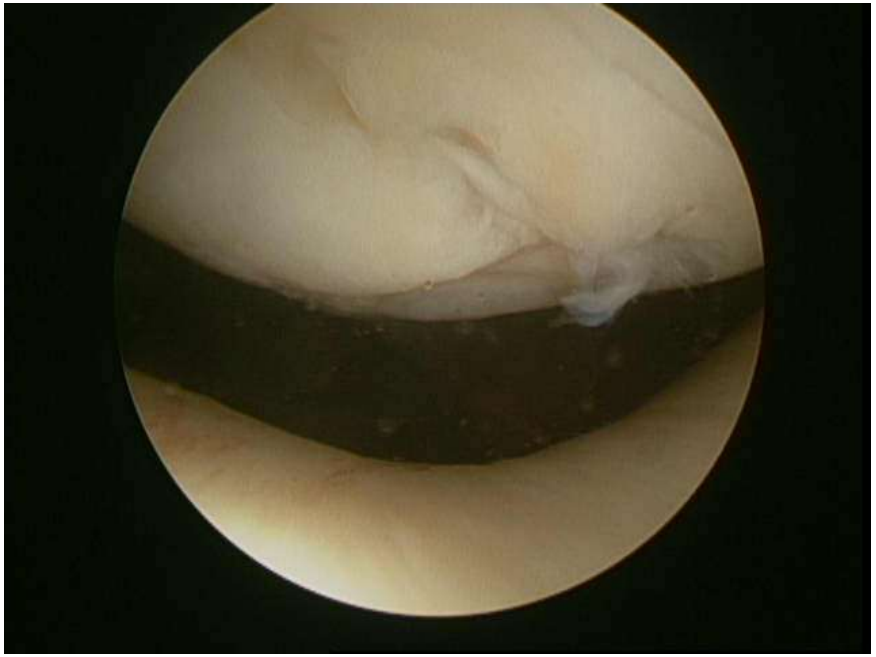


The initially formed blood clot as produced by microfracturing is protected by the collagen membrane.

Surgical technique

- technique for microfracture of patellar lesions



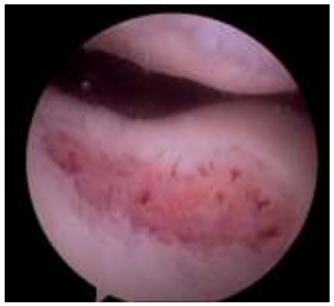


Rehabilitation

Femoral condyle

	WEIGHT BEARING	BRACE	ROM	THERAPEUTIC EXERCISE
PHASE I **0 - 8 weeks**	Touchdown weight bearing (20-30%) for the first 6-8 weeks.	None	Use of a CPM for 6-8 hours/day - set at a rate of 1 cycle/ minute, advancing 10 ° daily - begin at a level of flexion that is comfortable for the patient - advance to full flexion as tolerated	**Passive** stretching/exercise for the first 6 - 8 weeks, quad/hamstring isometrics
PHASE II **8 - 12 weeks**	Gradual return to full weight	None	Gain full and pain-free	Progressive active strengthening
PHASE III **12 weeks and beyond**	Full	None	Full and pain-free	Return to full activities, including cutting, turning, and jumping

Rehabilitation



Troclear-patellar defect

	WEIGHT BEARING	BRACE	ROM	THERAPEUTIC EXERCISE
PHASE I 0 - 8 weeks	Weight bearing as tolerated	Locked 0 - 40 ° of flexion for weight bearing	Use of a CPM for 6-8 hours/day - begin at a rate of 1 cycle/ minute, ranging from 0 - 40 °	**Passive** stretching/exercise for the first 6 - 8 weeks, quad/hamstring isometrics
PHASE II 8 - 12 weeks	Full	None	Gain full and pain-free	Begin closed chain activities, emphasizing a patellofemoral program
PHASE III 12 weeks and beyond	Full	None	Full and pain-free	Return to full activities, including cutting, turning, and jumping

Clinical studies

- The overall clinical results of the microfracture arthroplasty have shown improved knee function in 70% to 95% of patients

1. Steadman JR, Rodkey WG, Singleton SB, Briggs KK. Microfracture technique for full-thickness chondral defects. Technique and clinical results. Oper Tech Orthop. 1997;7:300-4.

2. Steadman JR, Miller BS, Karas SG, Schlegel TF, Briggs KK, Hawkins RJ. The microfracture technique in the treatment of full-thickness chondral lesions of the knee in National Football League players. J Knee Surg. 2003;16:83-6.

3. Steadman JR, Briggs KK, Rodrigo JJ, Kocher MS, Gill TJ, Rodkey WG. Outcomes of microfracture for traumatic chondral defects of the knee: average 11-year follow-up. Arthroscopy. 2003;19:477-84.

4. Kreuz PC, Steinwachs MR, Erggelet C, Krause SJ, Konrad G, Uhl M, Sudkamp N. Results after microfracture of full-thickness chondral defects in different compartments in the knee. Osteoarthritis Cartilage. 2006;14:1119-25.

Clinical studies

High-Impact Athletics After Knee Articular Cartilage Repair: A Prospective Evaluation of the Microfracture Technique

Kai Mithoefer, Riley J. Williams, III, Russell F. Warren, Thomas L. Wickiewicz and Robert G. Marx

Am. J. Sports Med. 2006; 34; 1413 originally published online May 30, 2006;

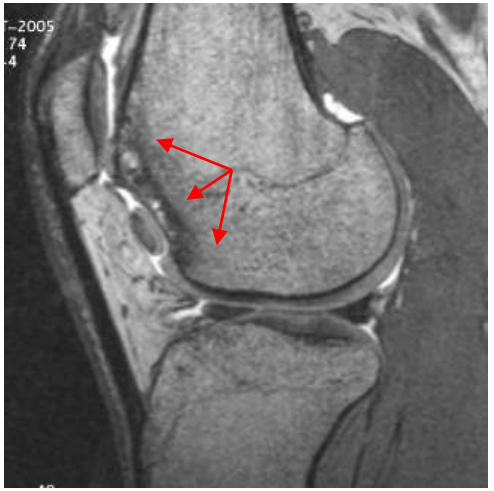
- 32 athletes were treated with microfracture for single articular cartilage lesions of the knee
- At last follow-up, 66% reported good or excellent results and 44% were able to regularly participate in high-impact, pivoting sports, 57% of these at the preoperative level.
- Return to high-impact sports was significantly higher in athletes with age <40 years, lesion size <200 mm^2, preoperative symptoms <12 months, and no prior surgical intervention.

High-Impact Athletic Activity Before Cartilage Injury and After Microfracture[a]

	Before Cartilage Injury		After Microfracture	
	n	%	n	%
Overall	32	100	14	44
Football	9	28	3	9
Soccer	5	6	1	3
Basketball	14	44	7	22
Tennis	13	41	4	13
Squash	1	3	1	3
Downhill skiing	7	22	6	19

Who is the ideal candidate for microfracture?

1. As a first line treatment
2. Isolated, well-contained lesion
3. Less than 12 months after the injury
4. Femoral condyle > troclear
5. Less than $4cm^2$
6. Less than 40 years
7. Low body mass index
8. Complied with the rehab program



Cell based therapy - ACI

ACI is ideal for symptomatic, unipolar, full thickness, or nearly full thickness chondral or shallow osteochondral defects.

Commonly, patients have failed previous treatments.

Occasionally, larger symptomatic lesions are indicated as a first line treatment.

Malalignment, ligament instability, and meniscus deficiency are not considered contraindications as long as they are addressed concomitantly or in a staged fashion

Knee Surg Sports Traumatol Arthrosc (2012) 20:1704–1713
DOI 10.1007/s00167-011-1732-5

KNEE

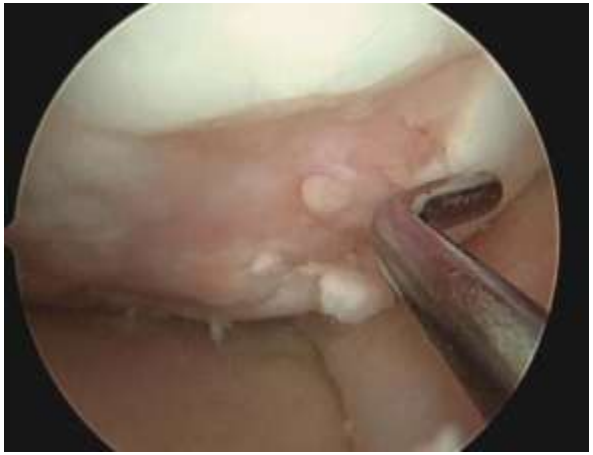
Second-generation arthroscopic autologous chondrocyte implantation for the treatment of degenerative cartilage lesions

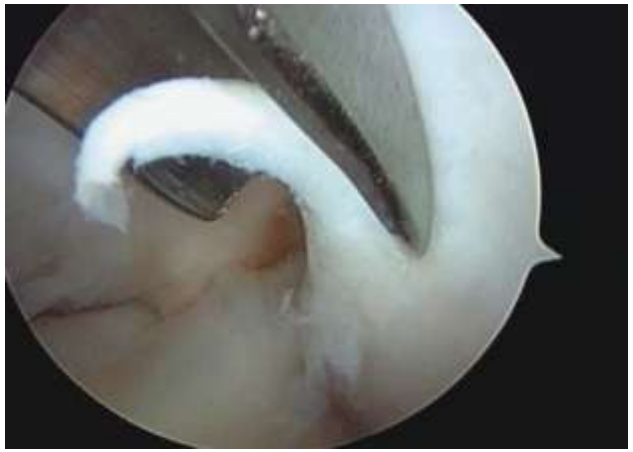
Giuseppe Filardo · Elizaveta Kon · Alessandro Di Martino · Silvio Patella · Giulio Altadonna · Federica Balboni · Laura Bragonzoni · Andrea Visani · Maurilio Marcacci

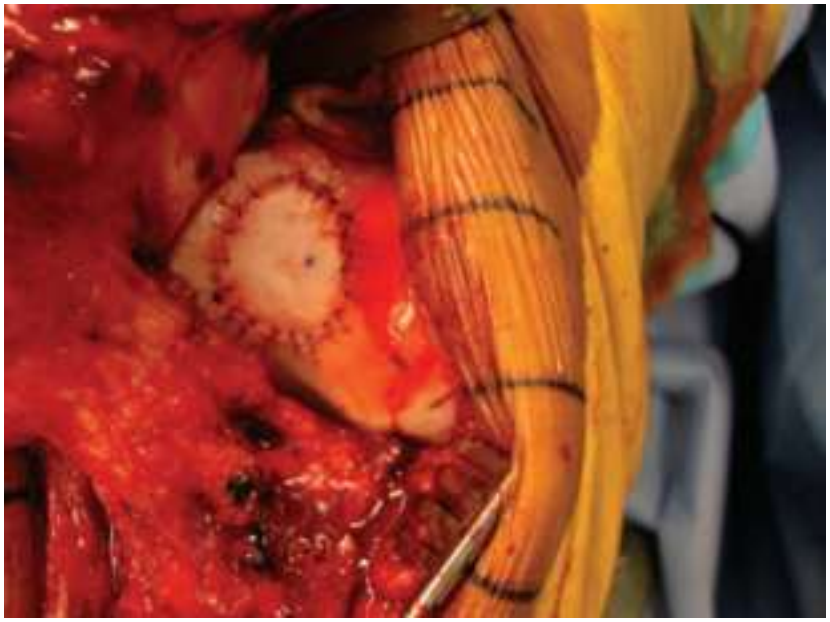
10/58 patients failed, making a total failure rate of 18.5% at the 6-year follow-up

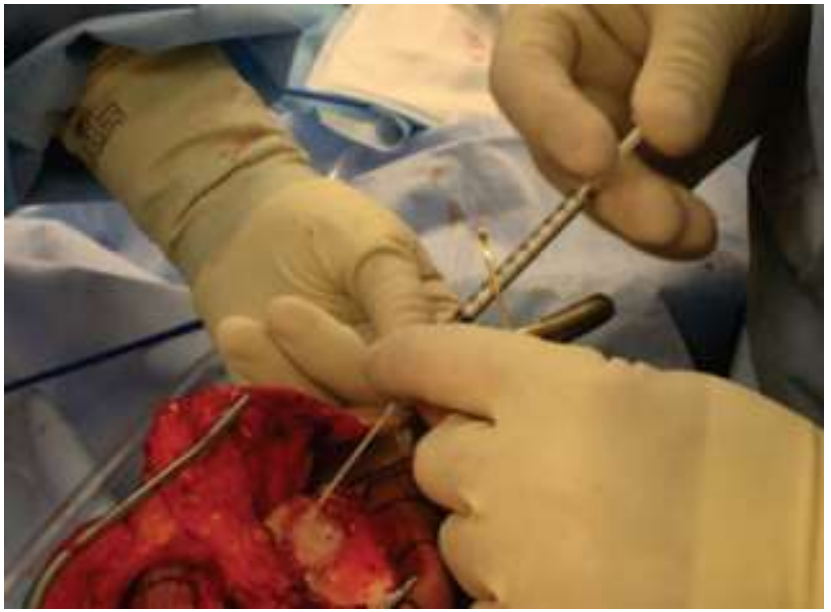
A lower improvement was observed in less-active patients, thus confirming our previous findings on the importance of sport activity and an active lifestyle for the medium-term clinical outcome after second-generation ACI

Typical P-ACI: surgical technique









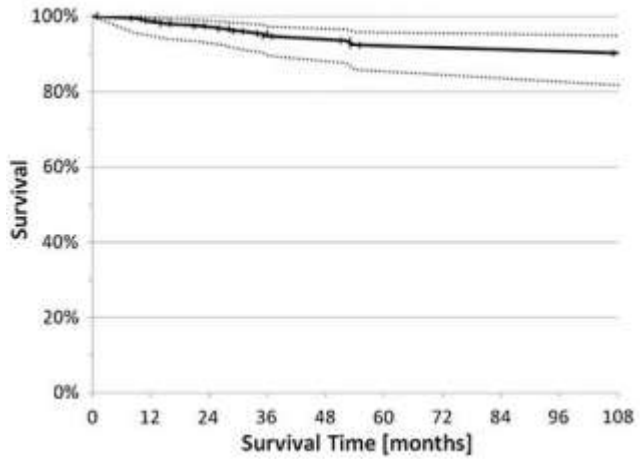
Clin Orthop Relat Res (2010) 468:147–157
DOI 10.1007/s11999-009-0998-0

SYMPOSIUM: PAPERS PRESENTED AT THE ANNUAL MEETINGS OF THE KNEE SOCIETY

Autologous Chondrocyte Implantation for Joint Preservation in Patients with Early Osteoarthritis

Tom Minas MD, MS, Andreas H. Gomoll MD, Shahram Solhpour MD, Ralf Rosenberger MD, Christian Probst BS, Tim Bryant RN

An average of 2.1 defects per knee was treated with an average defect size of 4.9 cm^2 and a total treated surface area of 10.4 cm^2 per knee joint



Our data demonstrate that ACI results in clinically relevant reductions in pain and improvement in function, while apparently delaying the need for knee arthroplasty for over 5 years in 92% of patients

Research article

Open Access

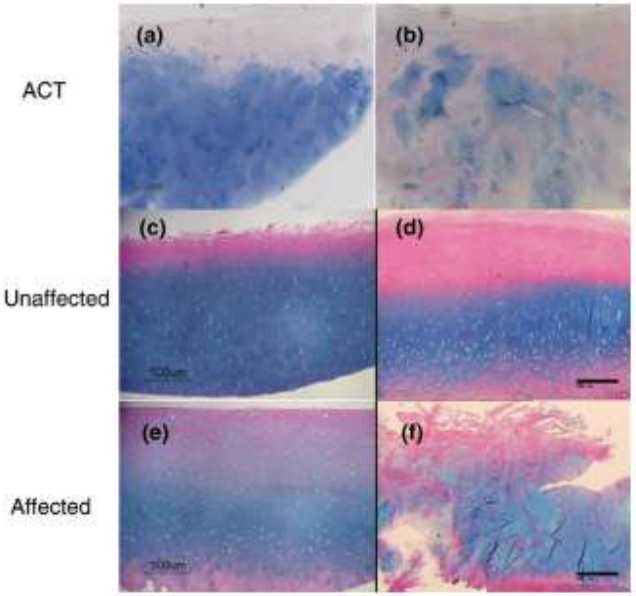
Proliferation and differentiation potential of chondrocytes from osteoarthritic patients

Tommi Tallheden[1], Catherine Bengtsson[1], Camilla Brantsing[1], Eva Sjögren-Jansson[1], Lars Carlsson[2], Lars Peterson[2], Mats Brittberg[2] and Anders Lindahl[1]

Arthritis Research & Therapy 2005, **7**:R560-R568 (DOI 10.1186/ar1709)

OA chondrocytes have the ability to proliferate, redifferentiate and secrete cartilage-specific matrix proteins. We also show that OA chondrocytes have an inability to shift definitely from a proliferative to a differentiating state

OA chondrocytes are able to bind to a scaffold, but further studies will be needed to establish how far the cartilage in this scaffold should be differentiated



Osteochondral autograft transfer

- patients less than 50 years

- full-thickness focal chondral defects

- < 4 cm^2

- femoral condyles

Clinical Experiences With Autologous Osteochondral Mosaicplasty in an Athletic Population : A 17-Year Prospective Multicenter Study

László Hangody, Jozsef Dobos, Eszter Baló, Gergely Pánics, Laszlo Rudolf Hangody and Istvan Berkes

Am J Sports Med 2010 38: 1125 originally published online April 1, 2010
DOI: 10.1177/0363546509360405

Osteoarthritic degenerative changes of Fairbank grade I or II were observed in 43% of the affected joints.

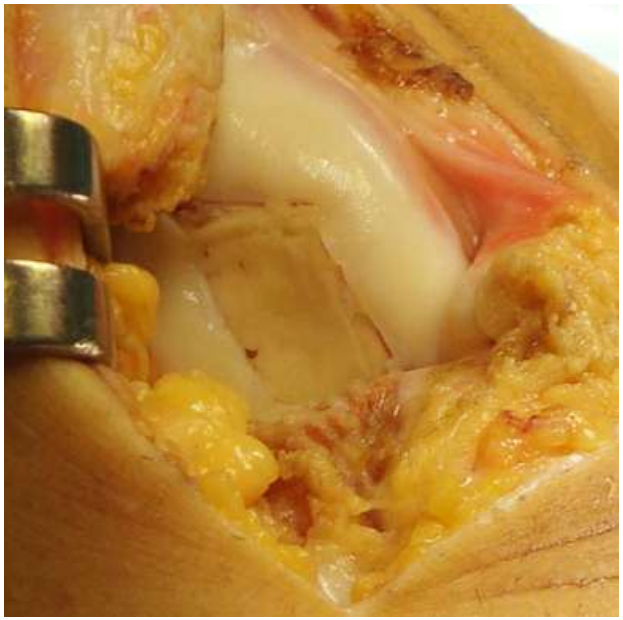
The average size of the chondral defects in treated knees was 2.0 cm

.

Only 8% of the athletes rated the postoperative knee function and symptom scores as being worse than before the procedure

Scaffolds, Matrix- assisted ACI

The ideal patient is less than 50-60 years old and has good joint environment:



Well contained focal defects

No more than 2-3 lesions

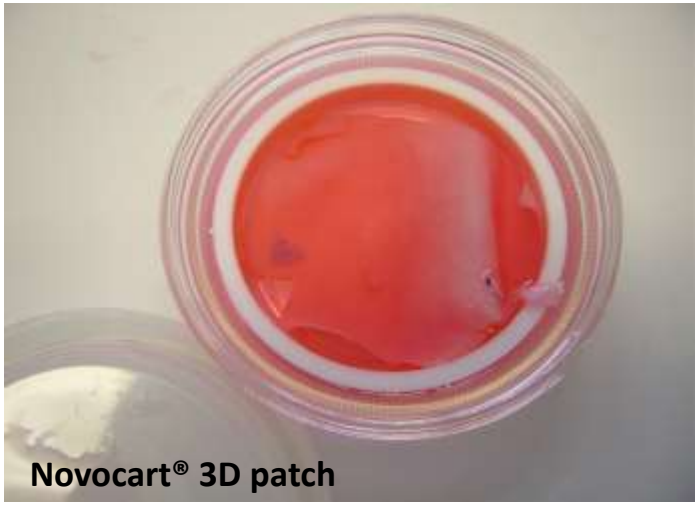
No ligamentous laxity

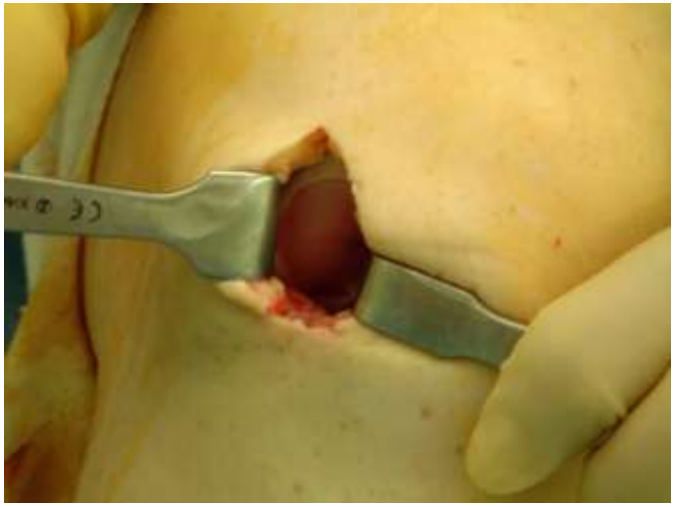
No generalized degeneration

Scaffolds: types

Chondral scaffolds are usually monophasic, even though some have a bilayer structure to better follow the biphasic composition of the osteochondral unit.

The most commonly used chondral matrices consist of collagen and hyaluronic acid.


Novocart® 3D patch



Scaffolds: types

MACI technique (bilayer collagen I/III matrix seeded with autologous chondrocytes)

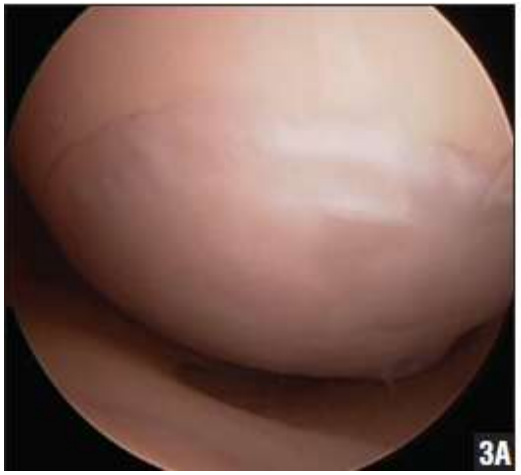
Chondro-Gide (bilayer porcine collagen I/III matrix)

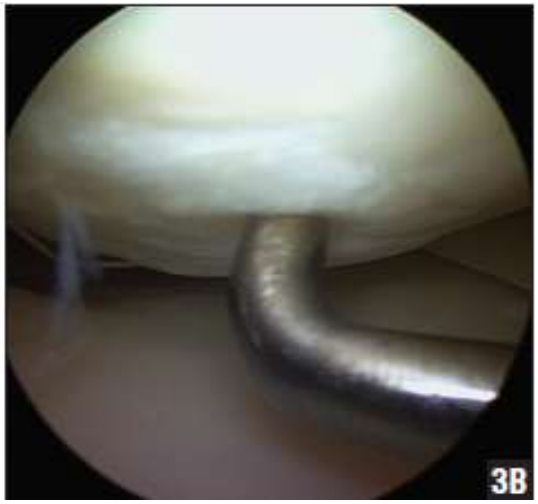
Hyalograft C or **HyalofastTM** (hyaluronic acid)

BioCart II (combines chondrocytes with a 3-dimensional open pore fibrin and hyaluronic acid matrix.

Bioseed C (fibrin, polyglycolic/polylactic acid, and polydioxanone)

Matrix- assisted ACI: surgical technique

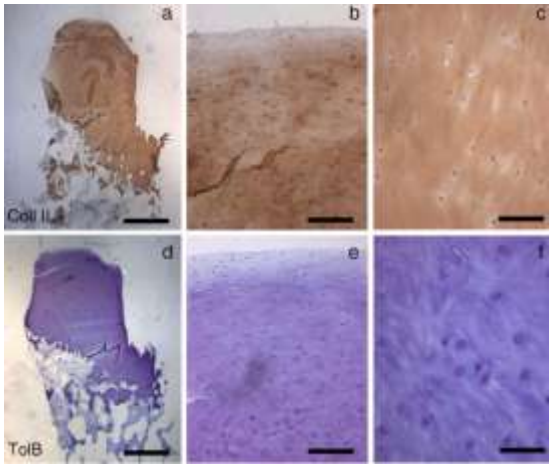




Available online at www.sciencedirect.com
SCIENCE DIRECT
The Knee 13 (2006) 194 – 202
THE KNEE
www.elsevier.com/locate/knee

Matrix-associated autologous chondrocyte transplantation/implantation (MACT/MACI)—5-year follow-up

Peter Behrens [a,*], Thomas Bitter [a], Bodo Kurz [b], Martin Russlies [a]



We could not detect a correlation between histological findings and clinical outcome based on the scores.

To conclude this study of 25 patients, MACT confirmed objective and subjective clinical improvement over a period of up to 5 years after operation

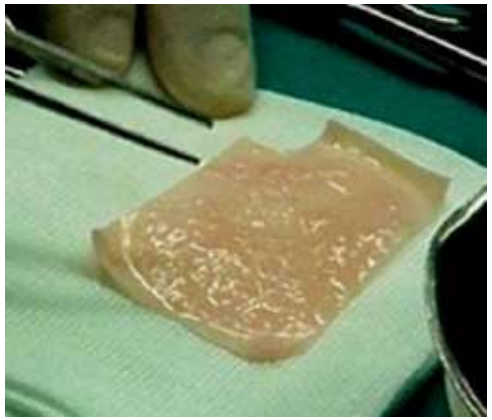
The MACT/ACI represents a very cost-intensive procedure and to date it is covered by private insurance in individual cases only. Therefore, we have not performed any MACT since 2001

Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-011-1575-0

KNEE

Repair of osteochondral lesions in the knee by chondrocyte implantation using the MACI® technique

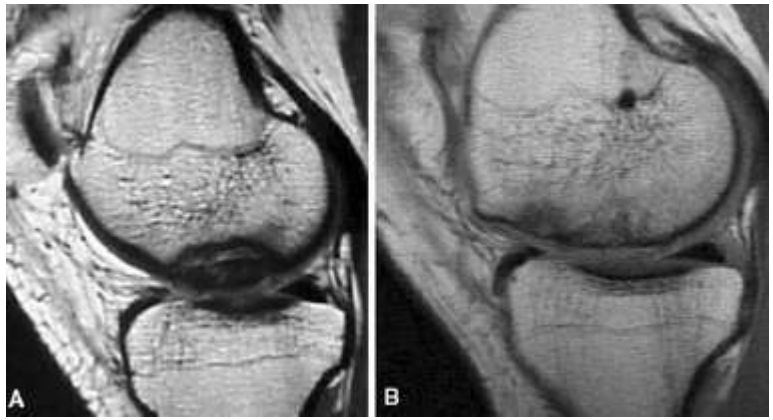
Alberto Ventura · Antonio Memeo · Enrico Borgo · Clara Terzaghi · Claudio Legnani · Walter Albisetti



53 patients with symptomatic isolated or multiple localized osteochondral defects (2–10 cm^2)

Mean age was 40 years (18–60 years).

Satisfying outcomes on 17 patients who were reevaluated 5 years after surgery.
At 60 months, MRI scans showed complete integration with the surrounding native cartilage without any sign of detachment or bone marrow edema in 15 cases



Autologous Chondrocyte Implantation for Knee Cartilage Injuries: Moderate Functional Outcome and Performance in Patients With High-impact Activities

ANDREAS PANAGOPOULOS, MD, PHD; LOUW VAN NIEKERK, FRCS(ED), FRCS(ORTH); IOANNIS TRIANTAFILLOPOULOS, MD, MSCI, PHD

Orthopedics, JANUARY 2012
Volume 35 • Number 1

The ideal candidate for ACI is

a young and fit patient

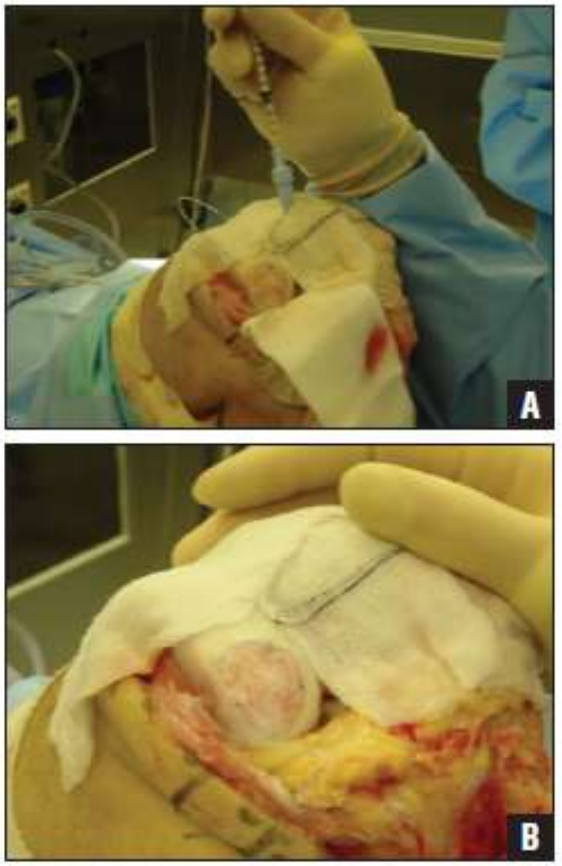
with high preoperative IKDC scores

and no previous operations

who is <12 months symptomatic

and has an isolated and small-sized

cartilage defect

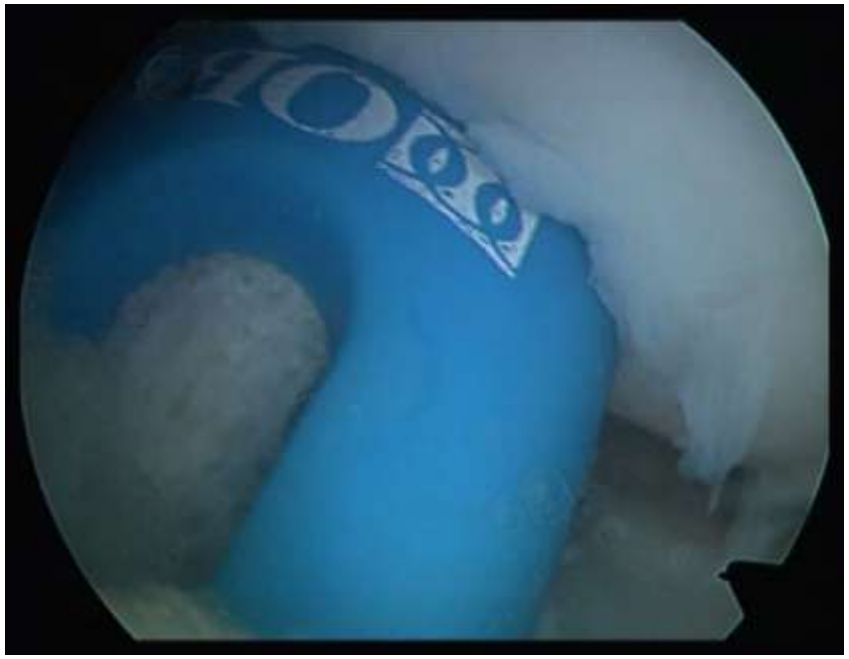


Biphasic scaffolds

Biphasic scaffolds for osteochondral regeneration :

Trufit: bilayer porous PLGA-calcium-sulfate biopolymer

Maioregen: nanostructured biomimetic scaffold with a porous 3-dimensional tri-layer hydroxyapatite-collagen composite structure, mimicking the osteochondral anatomy



2 years postoperatively

Barber FA, Dockery WD. **A computed tomography scan assessment of synthetic multiphase polymer scaffolds used for osteochondral defect repair**. Arthroscopy 2011:27:60–64

… the plugs do not show any evidence of bone ingrowth, osteoconductivity, or integration, but rather lead to subchondral cyst formation in all cases

Bedi A, Foo LF, Williams RJ, Potter HG et al. **The maturation of synthetic scaffolds for osteochondral donor sites of the knee: an MRI and T2-mapping analysis**. Cartilage 2010:1:20–28

…even an unfavorable mid-term MRI can significantly improve with time and therefore recommended perseverance

Kon E, Delcogliano M, Filardo G, Busacca M, Di Martino A, Marcacci M. **Novel nano-composite multilayered biomaterial for osteochondral regeneration: a pilot clinical trial.** Am J Sports Med 2011:39:1180–1190

28 pt / slower improvement was observed in older, less active patients, in case of adverse events or with patellar lesions.

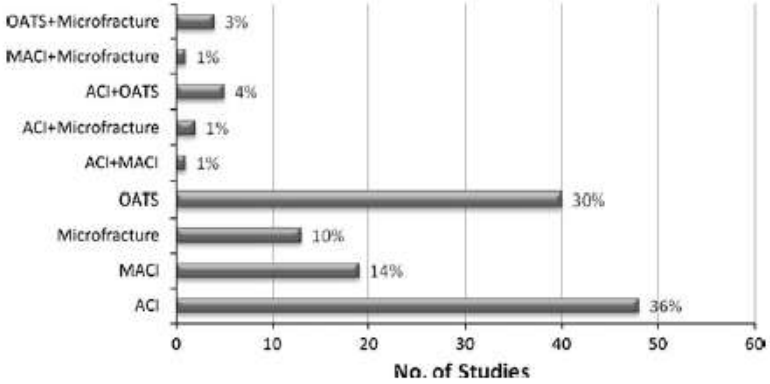
At 2 years, uniformly good results were seen in both clinical and MRI evaluations (complete filling and graft integration in 70% of the lesions

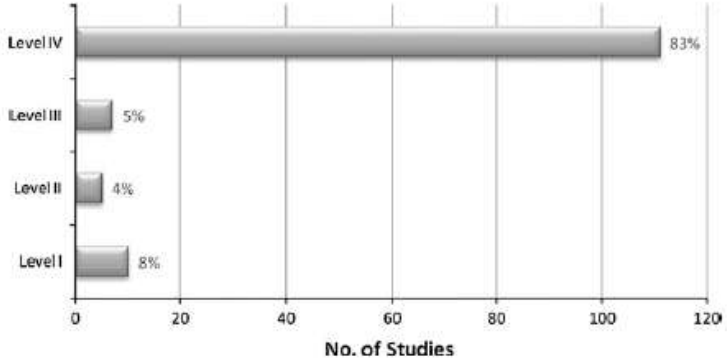
Knee Surg Sports Traumatol Arthrosc (2011) 19:543–552
DOI 10.1007/s00167-010-1271-5

KNEE

We do not have evidence based methods for the treatment of cartilage defects in the knee

Jan P. Benthien · Manuela Schwaninger · Peter Behrens





Knee Surg Sports Traumatol Arthrosc (2011) 19:543–552
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KNEE

We do not have evidence based methods for the treatment of cartilage defects in the knee

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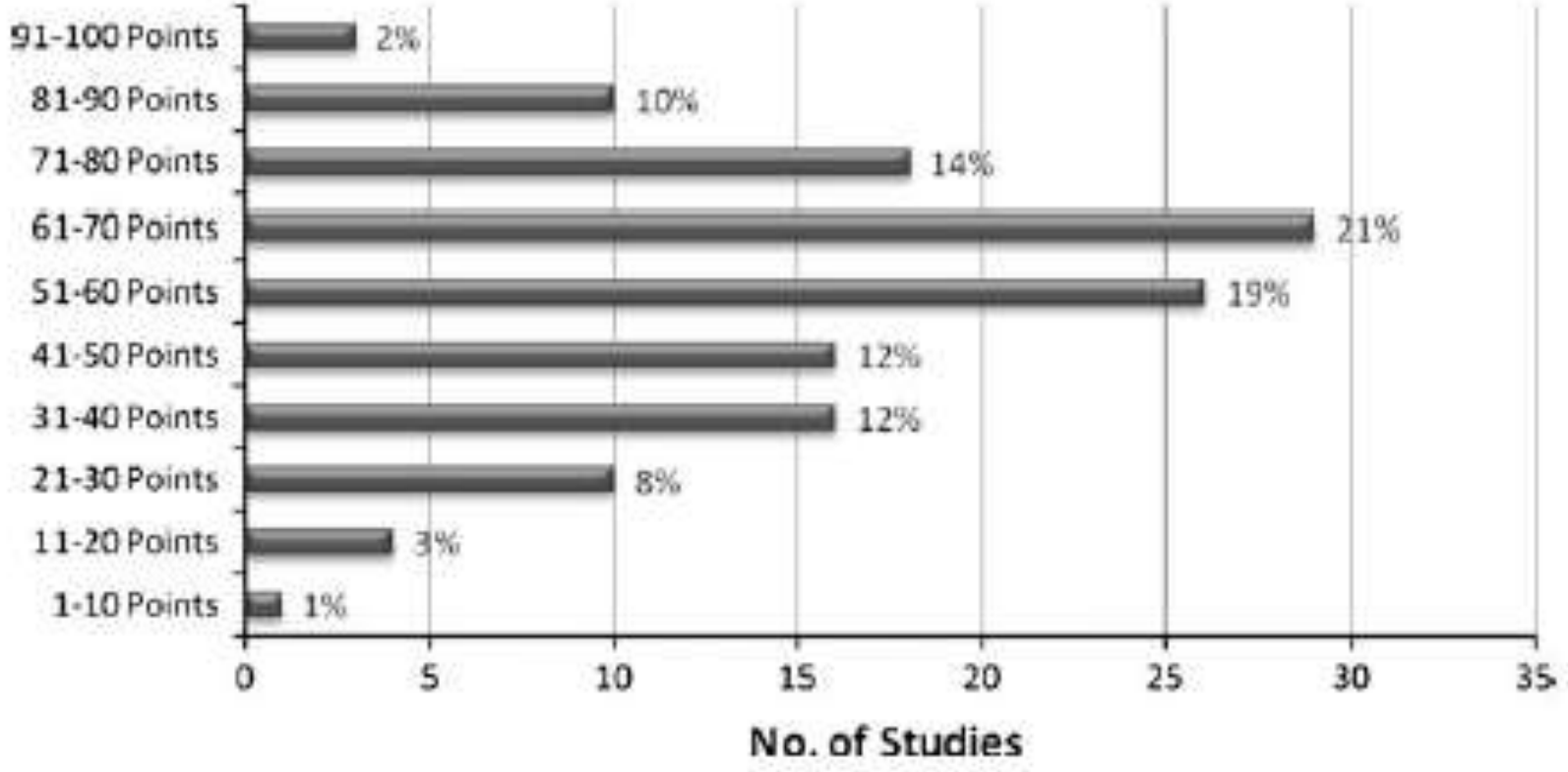


Knee Surg Sports Traumatol Arthrosc (2012) 20:468–486
DOI 10.1007/s00167-011-1714-7

KNEE

Surgical treatment for early osteoarthritis. Part II: allografts and concurrent procedures

A. H. Gomoll · G. Filardo · F. K. Almqvist · W. D. Bugbee · M. Jelic · J. C. Monllau · G. Puddu · W. G. Rodkey · P. Verdonk · R. Verdonk · S. Zaffagnini · M. Marcacci

Treatment options

1. Osteochondral allografts
2. Allogenic cartilage grafts
3. Meniscal scaffolds and allograft transplantation
4. Osteotomy

Osteochondral allografts

Indications

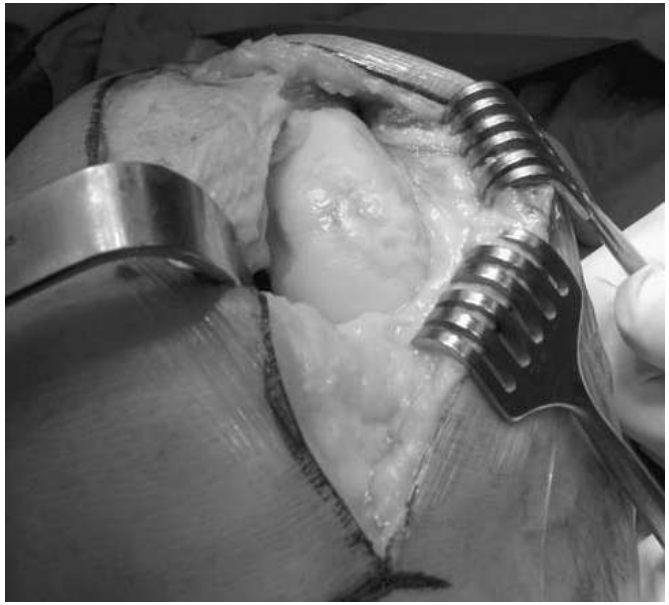
Table 2 Specific allograft reconstruction options for degenerative knee conditions

Condition	Reconstruction option
1. Spontaneous osteonecrosis of the medial femoral condyle	Focal allograft, with or without HTO
2. Steroid-associated osteonecrosis	Multiple plugs or shell graft
3. Tibial plateau fracture malunion	Combined tibial plateau allograft and meniscal transplantation, with or without osteotomy
4. Unicompartmental tibiofemoral arthrosis (secondary to meniscectomy or repetitive chondral trauma)	Realignment osteotomy, if indicated
	Bipolar allograft (tibial plateau with meniscus and plug or shell femoral allograft)
5. Patellofemoral arthrosis	Bipolar plug or shell allograft, with or without tibial tubercle osteotomy

Osteochondral allografts

- Availability
- size matched to the patient
- accredited tissue banks
- disease transmission
- high cost
- better fresh (viable cartilage)

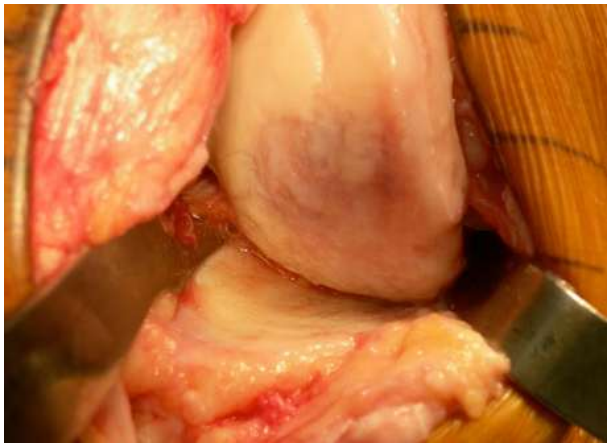
“sell allografts”
“bipolar allografts”



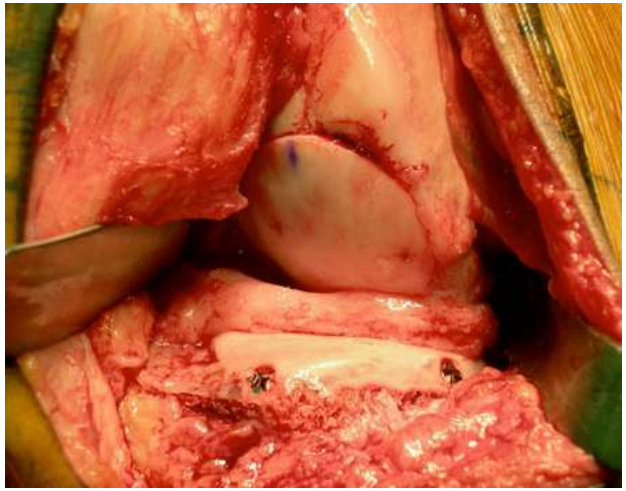
Osteochondral allografts

Technical aspects

A **plug graft** is, a round graft prepared by commercially available instruments that form grafts between 15 and 35 mm in diameter.



Shell grafts are more complex geometric shapes that must be prepared by hand. These are utilized for resurfacing the femoral condyle patella and tibial plateau.



Gross AE, KimW et al **Fresh osteochondral allografts for posttraumatic knee defects: long-term followup.** Clin Orthop Relat Res 2008:466:1863–1870

75% 10-year survivorship of tibial grafts in the management of post-traumatic OA and up to 75% good to excellent outcomes using allografts for patellofemoral disease.

Görtz S, De Young AJ, Bugbee WD **Fresh osteochondral allografting for steroid-associated osteonecrosis of the femoral condyles**. Clin Orthop Relat Res 2009:468:1269–1278

90% graft survival rate at 6 years

Prospective Evaluation of Prolonged Fresh Osteochondral Allograft Transplantation of the Femoral Condyle

Minimum 2-Year Follow-Up

Patrick C. McCulloch,* MD, Richard W. Kang,† Mohamed H. Sobhy,‡ MD, Jennifer K. Hayden,§ MS, and Brian J. Cole,†§|| MD, MBA

The American Journal of Sports Medicine

Vol. 35, No. 3, 2007

- 25 FOCA transplantation in femoral condyle
- average age 35 years (range, 17-49 years)
- follow-up: 35 months (range, 24-67)
- 84% satisfaction
- X-ray: 22 of the grafts (88%) were incorporated into host bone

Clin Orthop Relat Res (2008) 466:1863–1870
DOI 10.1007/s11999-008-0282-8

SYMPOSIUM: NEW APPROACHES TO ALLOGRAFT TRANSPLANTATION

Fresh Osteochondral Allografts for Posttraumatic Knee Defects

Long-term Followup

A. E. Gross MD, FRCSC, O.Ont, W. Kim MD, F. Las Heras MD, D. Backstein D, MD, MEd, FRCSC, O. Safir MD, FRCSC, K. P. H. Pritzker MD, FRCPC

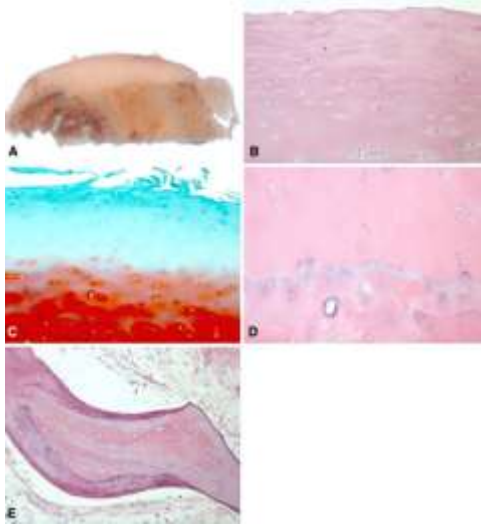


Table 1. Articular cartilage allografts: histologic findings

Tissue examined	Early retrieval (< 1 year) (six cases)	Midterm retrieval (2–5 years; average, 2.9 years) (11 cases)	Long-term retrieval (> 5 years; average, 12 years) (24 cases)
Cartilage	Normal thickness and architecture	Normal thickness and architecture	Normal thickness and architecture
	Retention of matrix and proteoglycan staining	Loss of matrix staining in the superficial and upper mid zones	Matrix staining normal except for superficial layer and upper mid zone
	Viable chondrocytes	Multiple chondrocytes within chondrons and some loss of chondrocyte polarity	Mostly viable chondrocytes with chondrocyte clusters and loss of chondrocyte polarity
Bone	Graft bone structurally intact	Host bone extends to subchondral plate with orderly resorption of graft bone by host bone	Host bone extends to and is apposed to calcified cartilage zone but variable remnants of dead bone surrounded by live bone persist
	No osteocytes in lacunae		
	Union of graft with host bone by 6 months		

Allogenic cartilage grafts

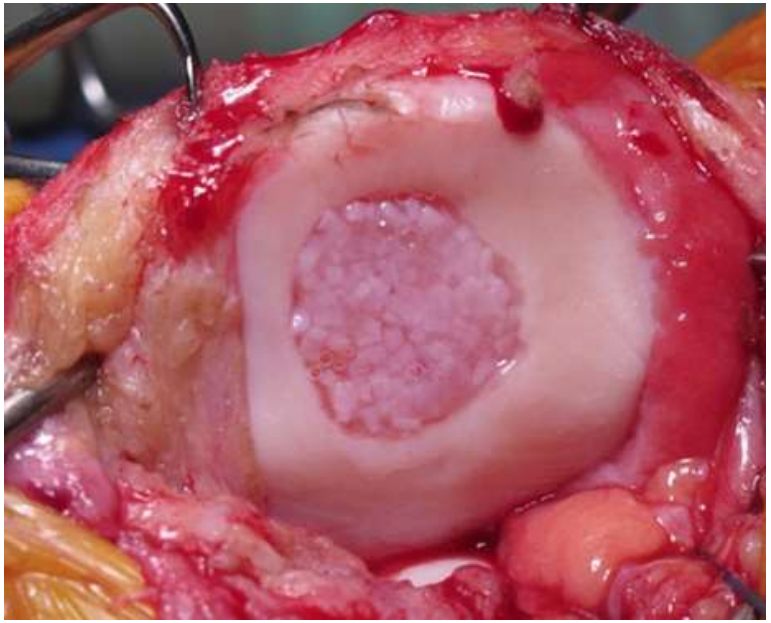
Allogenic cartilage grafts consist of the cartilage phase only, without attached bone. Therefore, they should be seen as a cell carrier, rather than structural graft.

1. **Morcellized cartilage allograft**
2. **Allogenic chondrocyte implants**

Morcellized cartilage allograft (1 mm^3 cubes of hyaline cartilage obtained from juvenile donor, resulting in a chondrocyte density 100-fold higher than that of adult cartilage (De Novo NT)

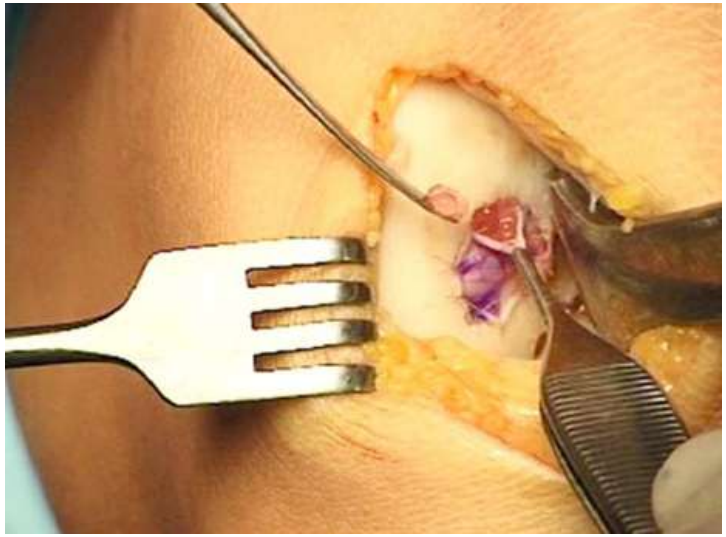
Farr J, Yao J (2010) Chondral defect repair with particulated juvenile cartilage allograft.e-poster 3863, ICRS meeting 2010, Sitges/Barcelona

7 patients with more than 1-year follow-up improved over baseline scores



Allogenic chondrocyte implants (cartilage is harvested and digested to release the cells contained within. The chondrocytes are isolated and mixed with alginate to form beads that are implanted into the cartilage defect

Almqvist KF, Dhollander AAM, Verdonk P, et al. **Treatment of cartilage defects in the knee using alginate beads containing human mature allogenic chondrocytes**. Am J Sports Med 2009:37:1920–1929



21 patients

follow up 36 months

mean age 33 years (12–47)

All lesions were focal: 15 on the MFC

ICRS grade III–IV mean size of 2.6 cm^2

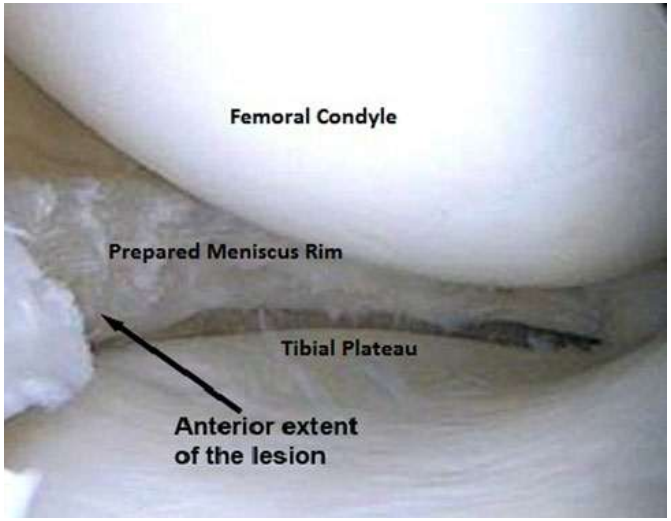
VAS pain and WOMAC scores improved significantly

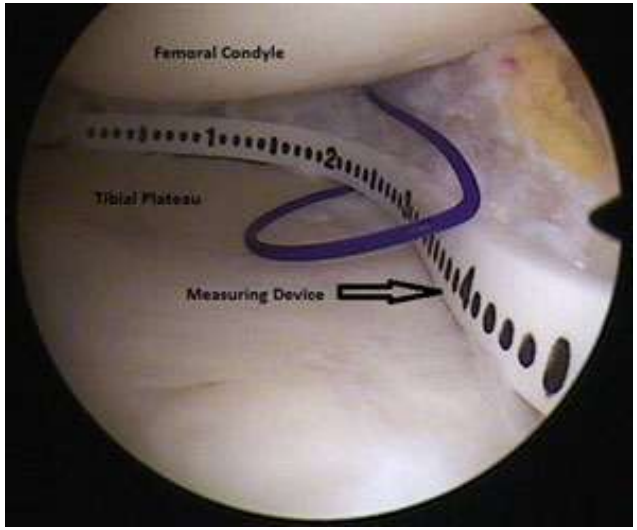
Meniscal scaffolds and allograft transplantation

Meniscal transplantation can be considered in case of massive/total meniscal resection. Meniscal replacement using scaffolds and meniscal allografts after partial and total meniscectomy, respectively, provides an important treatment option

Meniscal scaffolds

- > 25% loss of meniscal tissue due to trauma or surgical intervention
- no or minimal chondral damage
- Menaflex or Actifit





Monllau JC, Gelber PE, et al. Tey M) **Outcome after partial medial meniscus substitution with the collagen meniscal implant at a minimum of 10 years' follow-up**. Arthroscopy 2011:27:933–943

22 patients after a minimum of 10 years

Results were good or excellent in 83%

Radiographic evaluation showed either minimal or no narrowing of the joint line.

MRI was read as nearly normal in 64% of cases and normal in 21%.

Verdonk R, Verdonk P, Huysse W, Forsyth R, Heinrichs EL. **Tissue ingrowth after implantation of a novel, biodegradable polyurethane scaffold for treatment of partial meniscal lesions.** Am J Sports Med 2011:39:774–782

At 3 months postimplantation, early evidence of tissue ingrowth was observed on MRI in 86% of patients.

MRI findings at 12 months postimplantation showed stable or improved cartilage scores in the index compartment compared to baseline.

No evidence of necrosis or cell death, was observed in all biopsies taken at the 1-year second-look arthroscopy

Meniscal allograft transplantation

1. Young patients with a history of meniscectomy who have pain localized to the meniscus-deficient compartment, particularly after **lateral** meniscectomy.

2. ACL-deficient patients who have had previous medial meniscectomy with concomitant ACL reconstruction

3. In an effort to avert early joint degeneration, some also consider young, athletic patients who have had total meniscectomy as candidates for meniscal transplantation prior to symptom onset.

Meniscal allograft transplantation

Meniscal allografts are matched side- and size specific based on preoperative radiographs

as small as a 10% size mismatch has been found to have major effects

Open or athroscopic technique

Knee Surg Sports Traumatol Arthrosc (2006) 14: 694–706
DOI 10.1007/s00167-005-0033-2

KNEE

Peter C. M. Verdonk
Koenraad L. Verstraete
Karl F. Almqvist
Kristof De Cuyper
Eric M. Veys
Gust Verbruggen
René Verdonk

Meniscal allograft transplantation: long-term clinical results with radiological and magnetic resonance imaging correlations

Radiographical analysis revealed no further joint narrowing in 13/32 knees (41%).

MRI analysis showed no progression of degeneration in 6/17 knees (35%).

Osteotomy

Indications

Malalignment associated with unicompartmental OA, cartilage or meniscal lesions, and ligament instability

Preoperative MRI or concomninant arthroscopy to assess the articular surface and meniscus of the contralateral compartment.

Contraindications

meniscal lesion in the contralateral compartment
decreased < 90 degrees of flexion or more than 15 degrees of flexion contracture,
tibial subluxation greater than 1 cm,
obesity, smoking and compromised bone stock

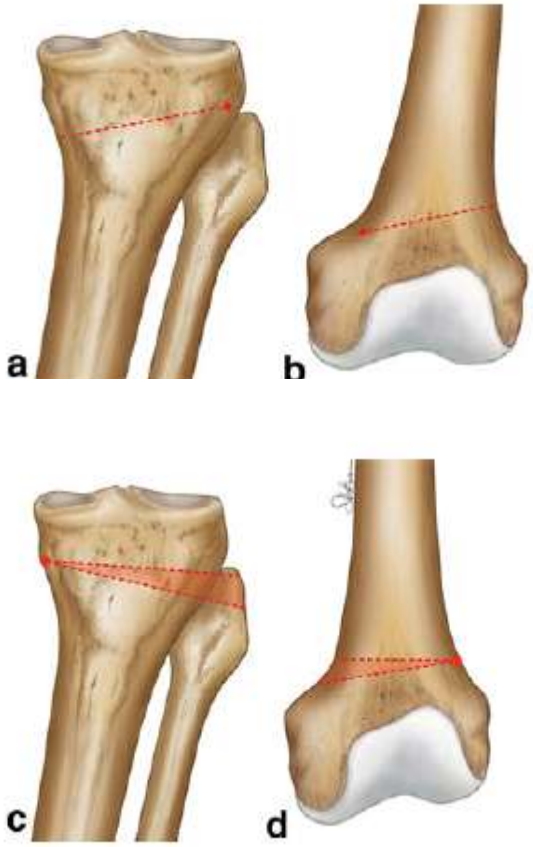


Fig. 8 a Medial opening-wedge HTO. b Lateral opening-wedge DFO. c Lateral closing-wedge HTO. d Medial closing-wedge DFO

Medial opening-wedge HTO

A medial opening HTO is usually performed when a severe varus deformity is present with proximal tibial malrotation,

Also when we need to correct tibial slope in case of associated ligament laxity.

preservation of the tibiofibular joint, no risk of injury to the peroneal nerve, no loosening of posterolateral structures, no limb shortening and easier adjustment of the tibial slope.

Lateral closing-wedge HTO

Performed for OA patients with no morphotype alterations and with light or moderate deformity. However, it is more difficult to change the tibial slope.

Does not require bone, grafting, allows earlier weight-bearing, has less risk of nonunion, and loss of correction.

The need for fibular osteotomy increases the risk of nonunions and peroneal nerve palsy.

Lateral DFO

For the varus-producing osteotomies, we aim to move the mechanical axis to a point 48–50% across the width of the tibial plateau from lateral to medial , mostly by means of a DFO and only in select cases by a medial closing-wedge HTO.

OSTEOTOMY RESULTS

At 5 years, 70–90% of patients report satisfactory outcomes, which decreases to 50–70% at 15 years

Efe T, Ahmed G, Heyse TJ, et al . **Closing-wedge high tibial osteotomy: survival and risk factor analysis at long-term follow up**. BMC Musculoskelet Disord 2011;12:46

Gstöttner M, Pedross F, Liebensteiner M, et al . **Longterm outcome after high tibial osteotomy.** Arch Orthop Trauma 2008:Surg 128:111–115

Saragaglia D, Blaysat M, Inman D, Mercier N. **Outcome of opening wedge high tibial osteotomy augmented with a Biosorb wedge and fixed with a plate and screws in 124 patients with a mean of ten years follow-up**. Int Orthop 2010 35:1151–1156.

International Orthopaedics (SICOT) (2010) 34:231–237
DOI 10.1007/s00264-009-0922-y

ORIGINAL PAPER

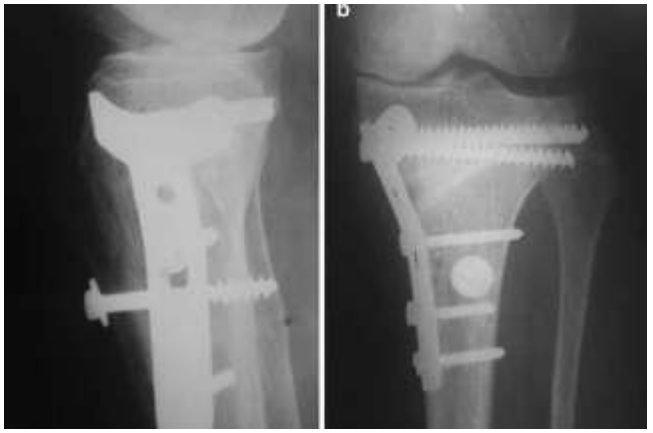
The new "dual osteotomy": combined open wedge and tibial tuberosity anteriorisation osteotomies

Wael Samir Abdel Megied · Mahmoud A. Mahran · Mootaz F. Thakeb · Amr A. K. H. Abouelela · Yasser Elbatrawy

30 patient with medial compartment OA and patellofemoral OA

open wedge HTO was combined with 1- to 1.5-cm Maquet-like tibial tuberosity anteriorisation

70% of patients experienced no pain



The Knee 19 (2012) 431–439

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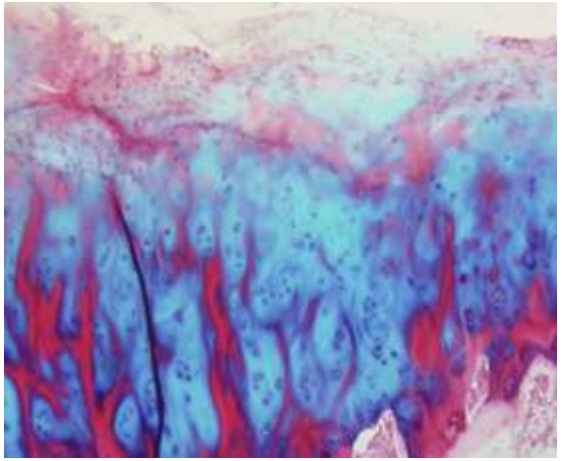
The Knee

Knee joint preservation with combined neutralising High Tibial Osteotomy (HTO) and Matrix-induced Autologous Chondrocyte Implantation (MACI) in younger patients with medial knee osteoarthritis: A case series with prospective clinical and MRI follow-up over 5 years

S. Bauer [a,*], R.J.K. Khan [a], J.R. Ebert [b], W.B. Robertson [a], W. Breidahl [c], T.R. Ackland [b], D.J. Wood [a]



This combined procedure provides a safe treatment option for younger patients with medial knee OA and varus alignment with significant clinical improvement at 5 years.

However, overall graft survival and cartilage infill were poor (MRI study).

Conclusions

Young patients with early OA represent a challenging population due to a combination of high functional demands and limited treatment options.

Conservative measures such as injection and physical therapy can provide short-term pain relief but are only palliative in nature

Conclusions

Joint replacement, a successful procedure in the older population, is controversial in younger patients, who are less satisfied and experience higher failure rates.

Specifically patients younger than 40 can only expect a 50% chance of good and excellent Knee Society function scores and a **revision rate of 12.5%** at 8 years

Conclusions

Cartilage repair techniques with/or without osteotomy therefore, appears as a potentially promising treatment alternative for the young patient with disabling symptoms from early knee OA