BONE MARROW STIMULATION PROCEDURES

Jean-Marie FAYARD*, Martin HECKI*, Elvire SERVIEN**

*Centre Orthopédique Santy, Lyon, France

**Orthopaedic surgery and sport medicine department, Lyon University Hospital, France

DISCLOSURE

- Arthrex (consultant)
- NewClip Technics (consultant, royalties)
- X Nov (royalties)
- Doct’Up App (owner, developer)

CARTILAGE DEFECTS OF THE KNEE

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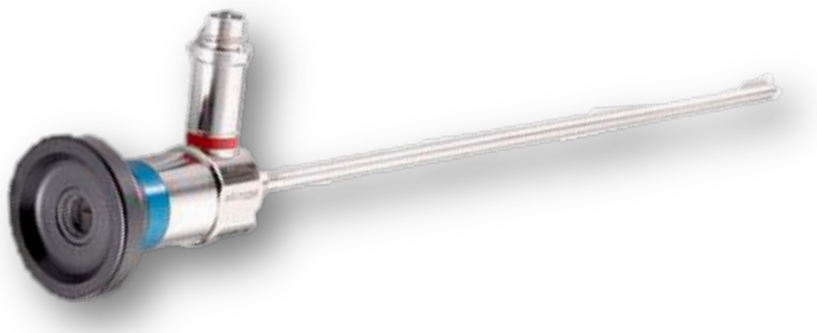
Extensive

Degenerative

Arthroplasty

CARTILAGE DEFECTS OF THE KNEE



Focal

Isolated

OCD

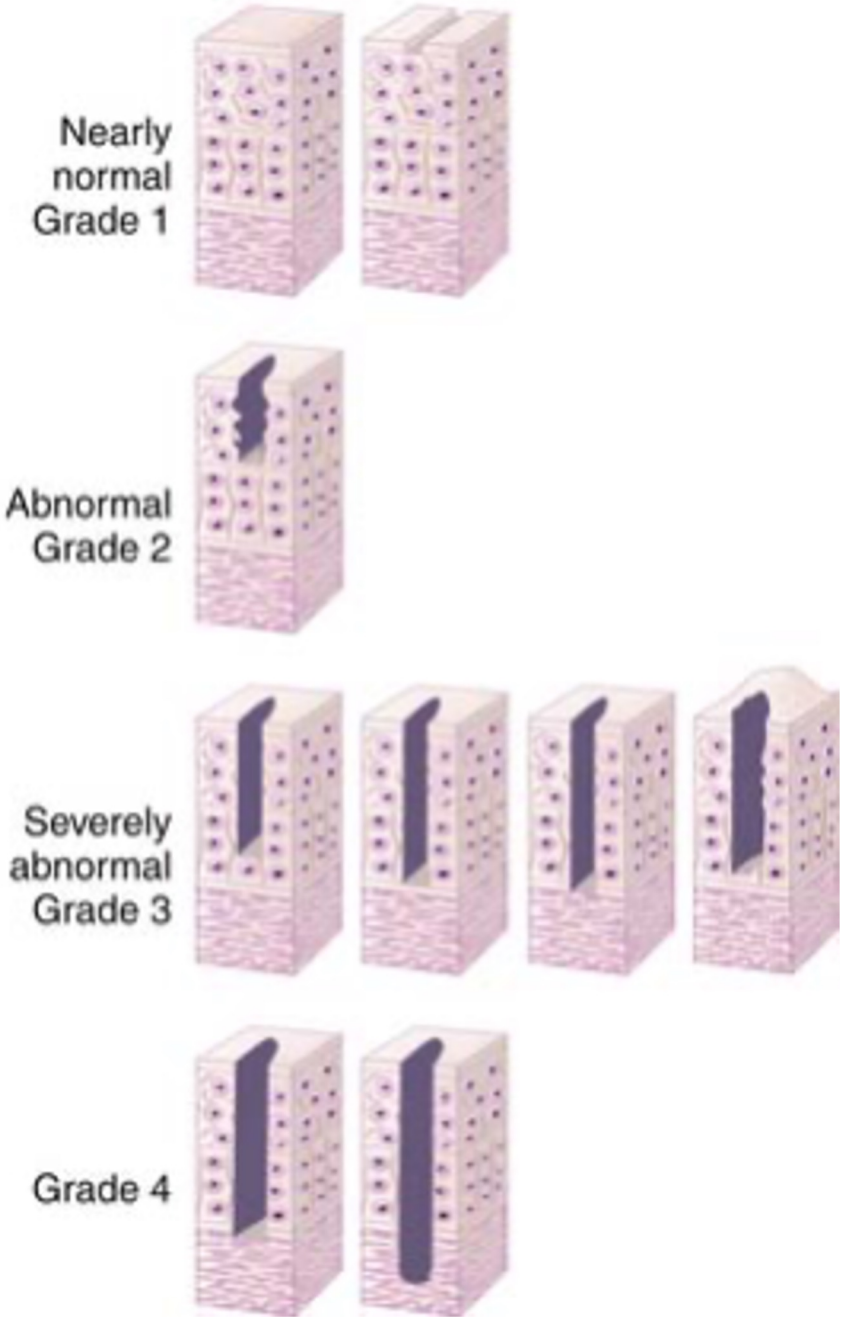
Trauma

Cartilage Surgery

ICRS GRADING SYSTEM

International Cartilage Repair Society

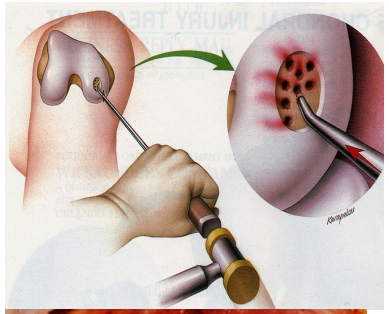
Grade 1	Nearly normal	Superficial lesions
Grade 2	Abnormal	< 50% of cartilage depth
Grade 3	Severely abnormal	> 50% of cartilage depth
Grade 4	Severely abnormal	Through subchondral bone



SURGICAL SOLUTIONS

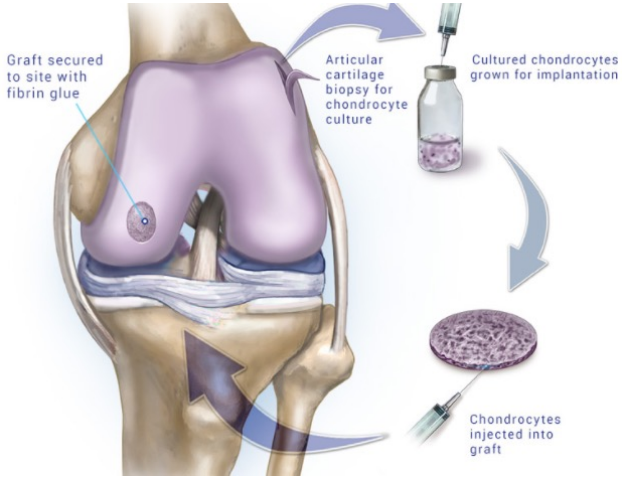
PALLIATIVE STIMULATION :

- Marrow Stimulation Procedures



REPAIR TECHNIQUES:

- Osteochondral autograft : Mosaicplasty
- Osteochondral allograft transplantation
- Autologous chondrocyte implantation (ACI)
- Matrix-associated ACI (MACI)

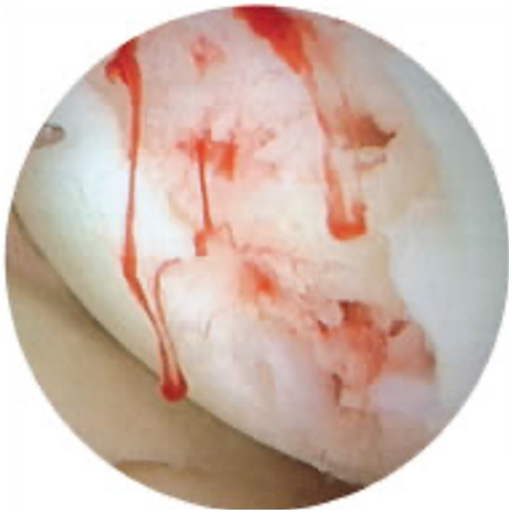


GOALS

Abrasion
Microfractures

Bleeding

Blood clot



Growth
factors

FIBROCARTILAGE
Type 1 collagen

Less resistant to shear forces

~~HYALINE CARTILAGE~~
~~Type 2 collagen~~

MARROW STIMULATION TECHNIQUES

Osteochondral drilling

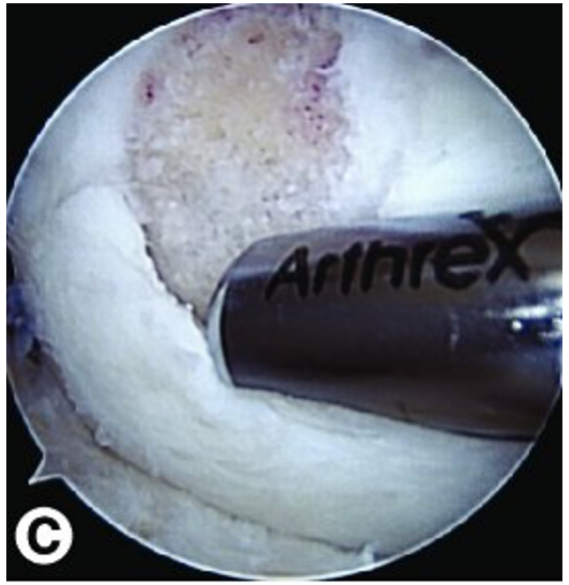
Pridie (60's)

Motorized

1.5 drill – 18/20 K-Wire

Abrasion chondroplasty

Johnson (80's)



Motorized burr

MARROW STIMULATION TECHNIQUES

Osteochondral drilling

Pridie (6

Motorized

1.5 drill – 18/20 K-Wire

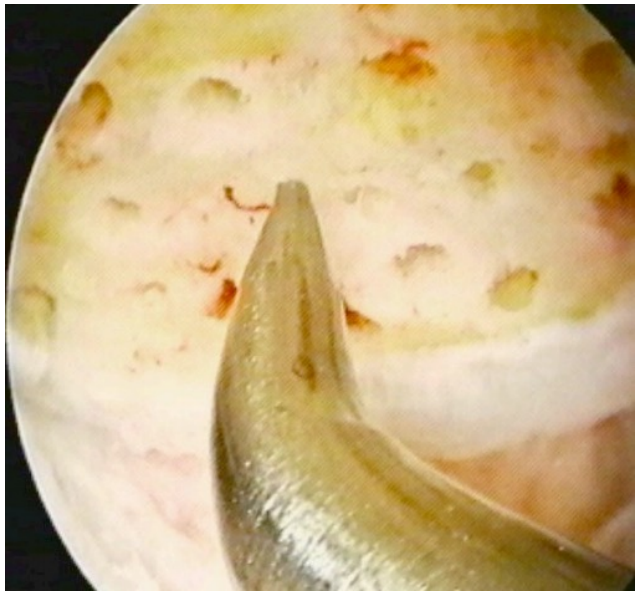
Abrasion chondroplasty

Johnson (80's)

Motorized burr

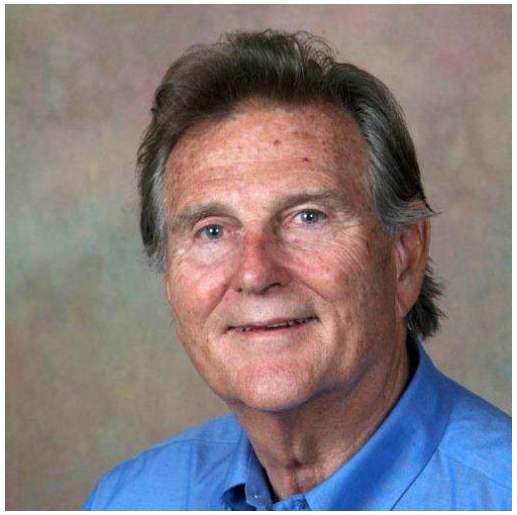
Microfracture

Steadman(90's)

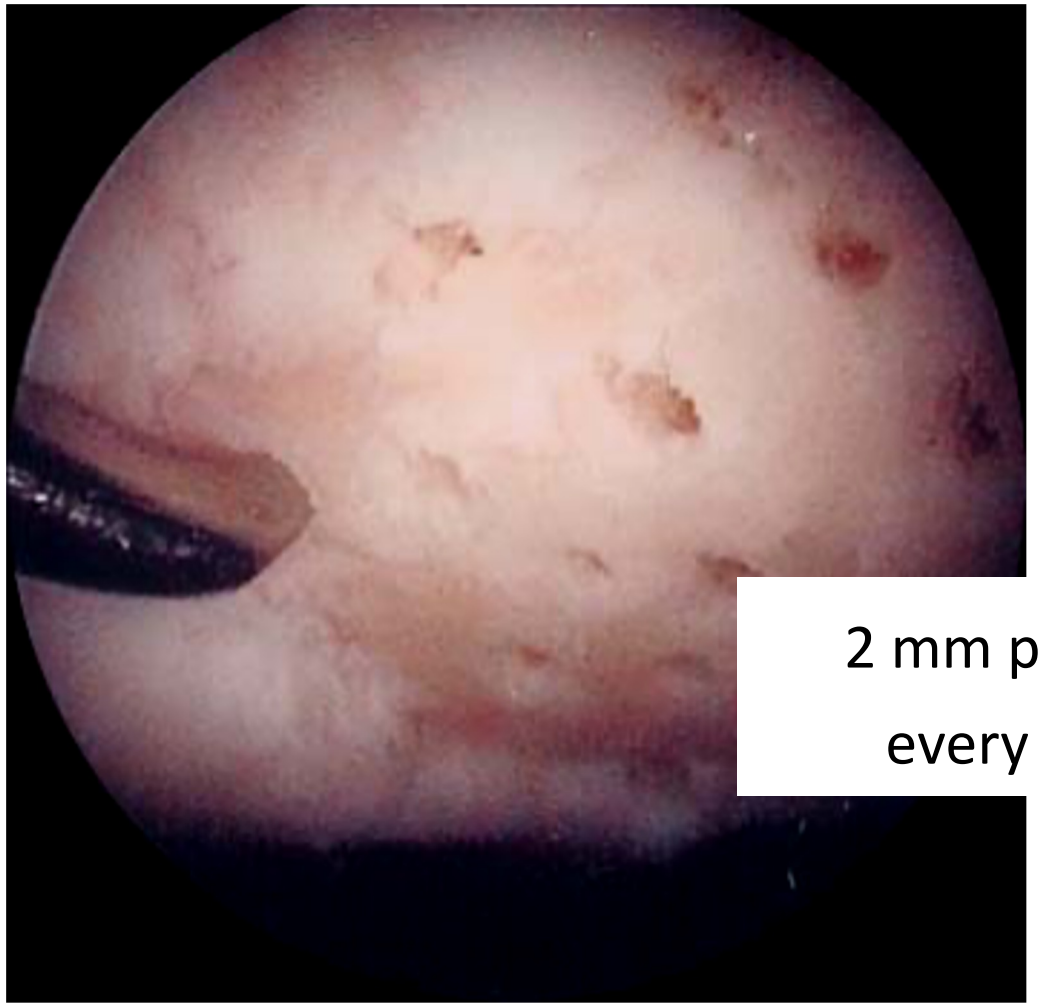


Perforations

Inconsitent results



JR. STEADMAN



2 mm perforations

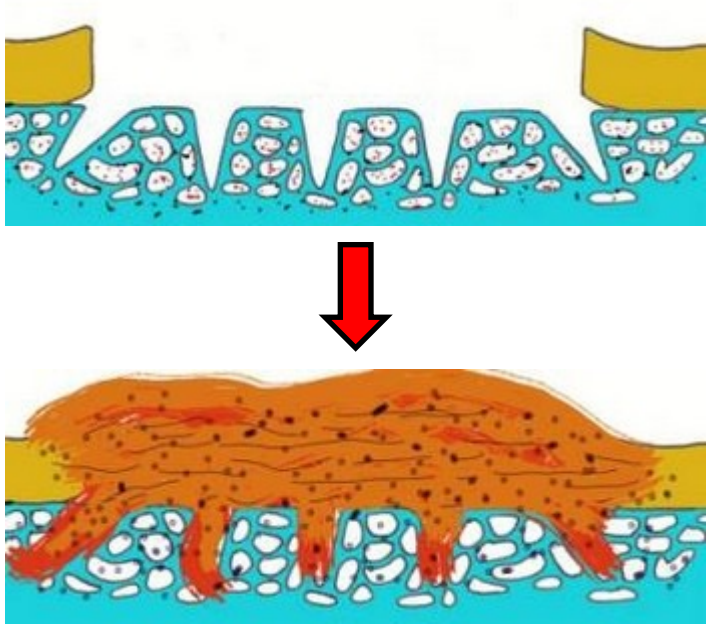
every 3 – 4 mm

Steadman JR. and al. Microfracture technique for full-thickness chondral defects: technique and clinical results. Oper Tech Orthop. 1997;7:300–4.

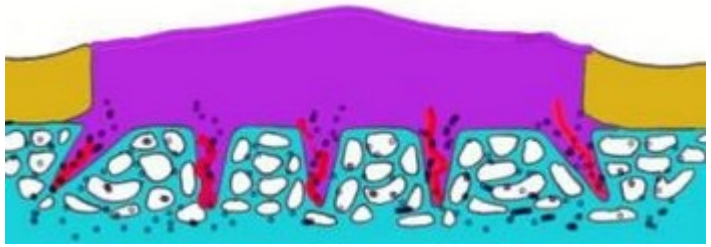
Principles

Rebuild « cartilage » with mesenchymal stem cells

Debridment (clean the defect) & multiples holes

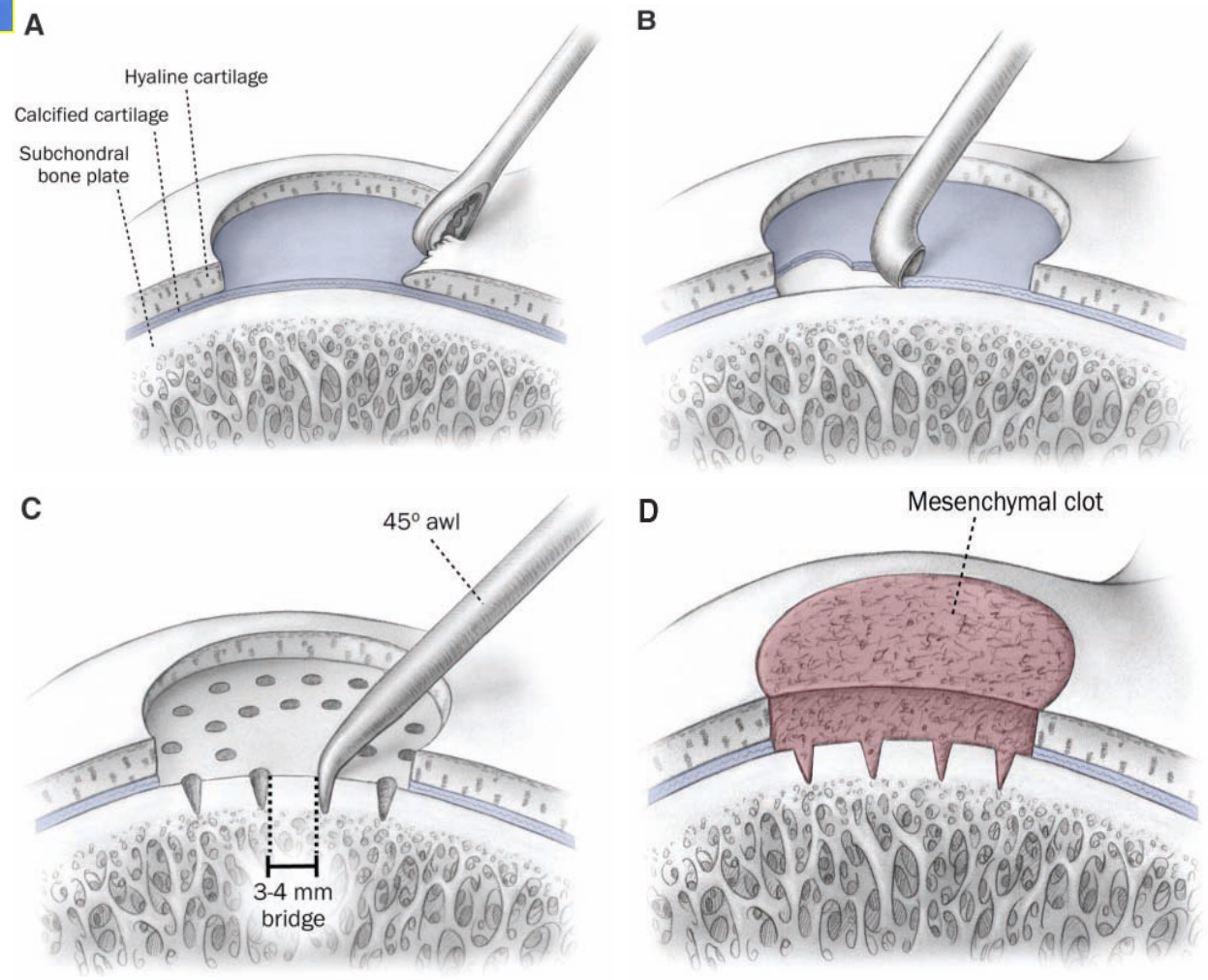


Clot formation



Healing cartilage

Procedure

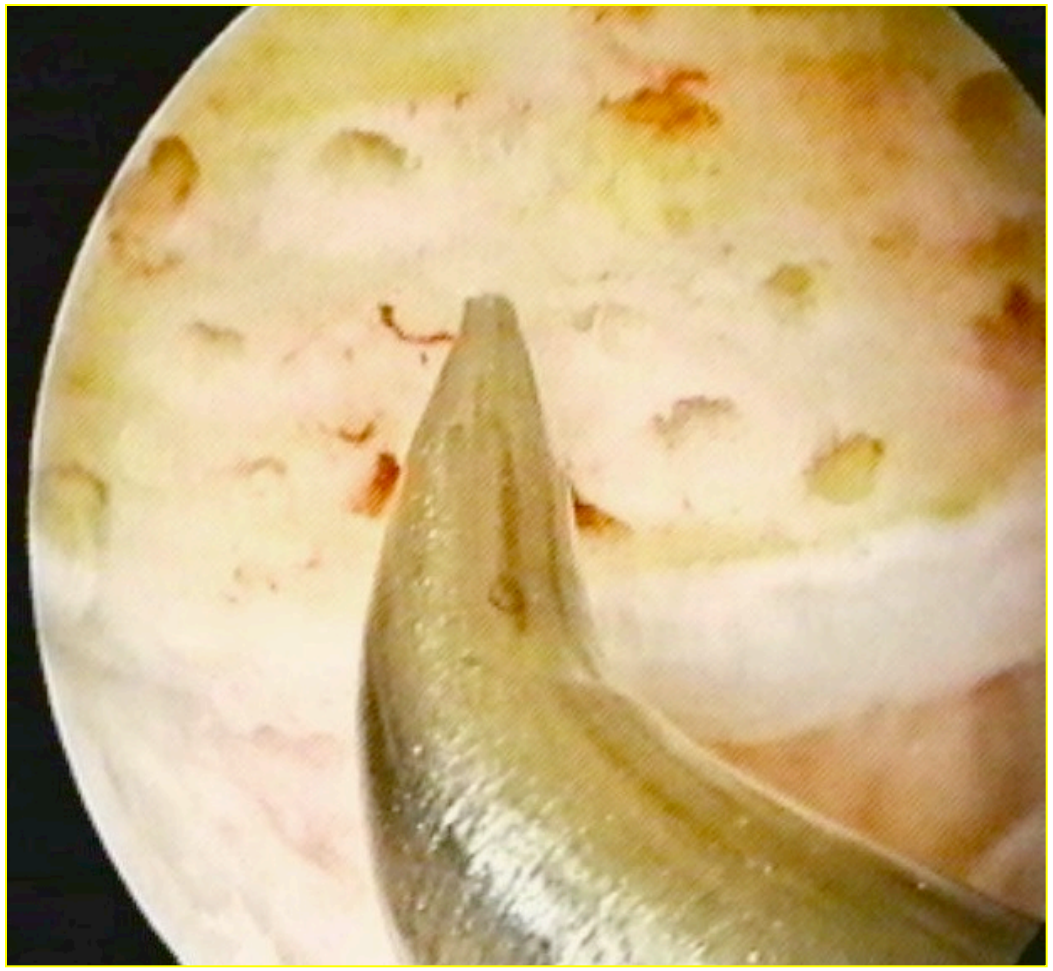


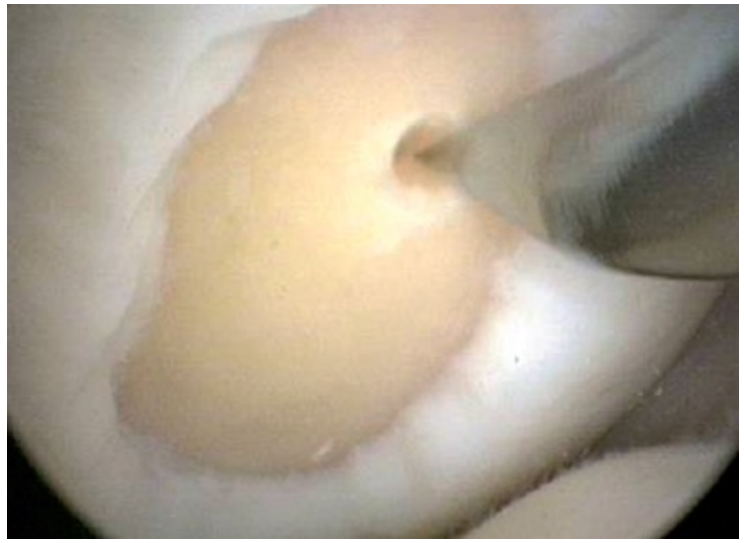
K. Mithoefer and coll. American Journal of Sports Medicine, 2009, Vol. 37, No. 10

Special ancillary

3 – 4 mm deep

every 3 - 4 mm





Injury, Int. J. Care Injured (2008) 39S1, S26–S31

ELSEVIER

INJURY
INTERNATIONAL JOURNAL OF THE CARE OF THE INJURED

www.elsevier.com/locate/injury

Marrow stimulation techniques

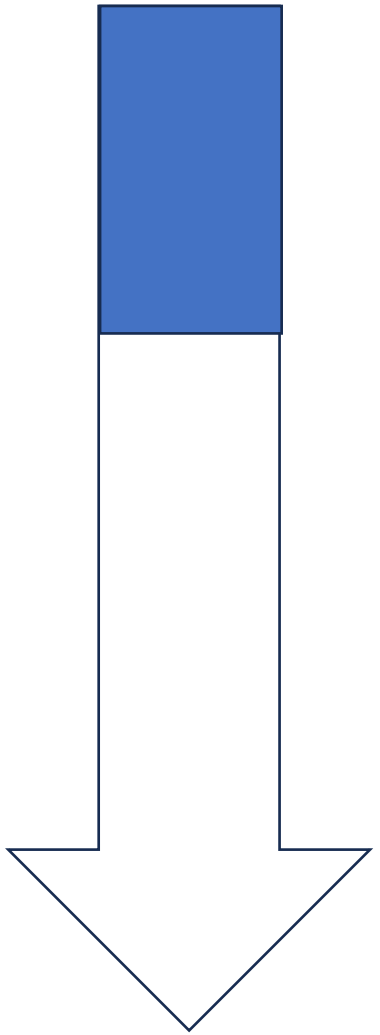
MR Steinwachs[1], Th Guggi[1], PC Kreuz[2]

POSTOP CARE: 3 phases

- **Healing phase (week 0-6):**
Non WB+++
Edema reduction, ROM recovery, low resistance strenghtening

- **Transition phase (week 6-12):**
Progressive WB, gait training

- **Remodeling phase (week 13+)**
Impact loading & athletics
Pivoting/ jumping 4-6 months
Full sports 9 months



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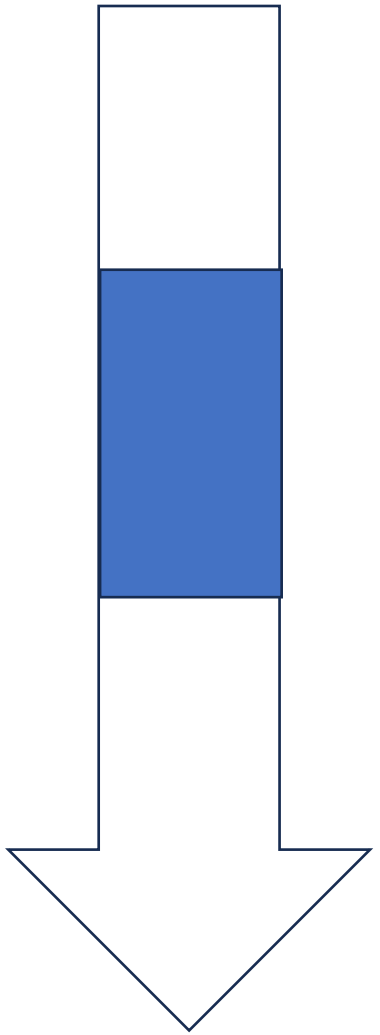

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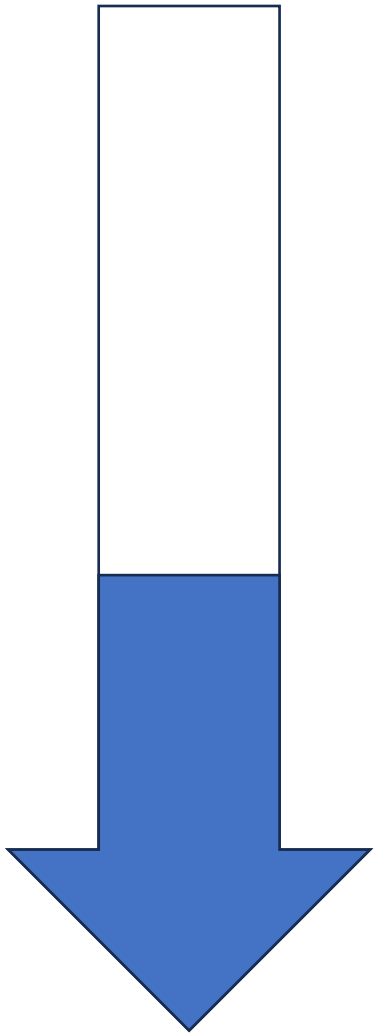
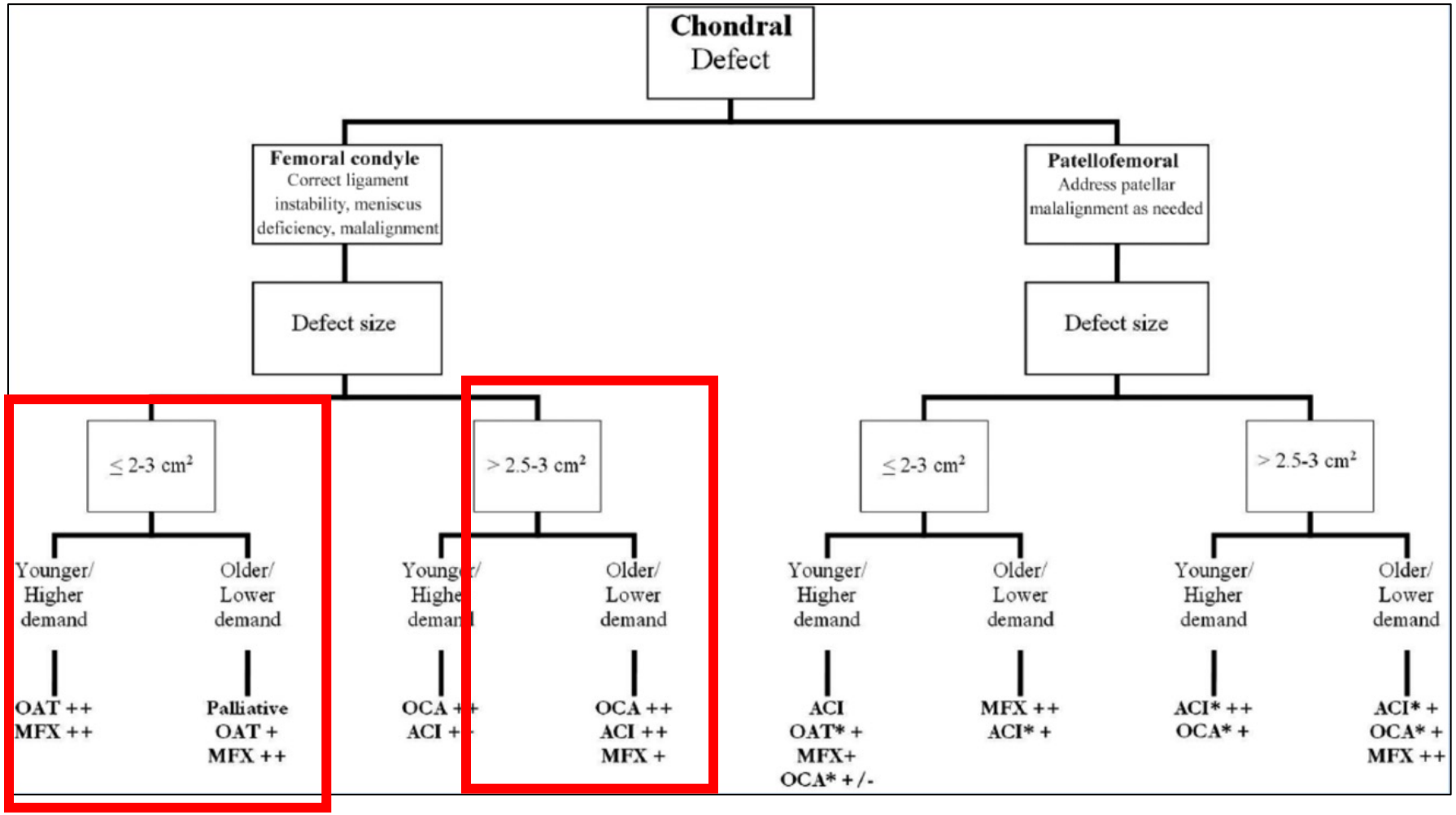


INDICATIONS



2,1 cm²

2,5 cm²

3,5 cm²

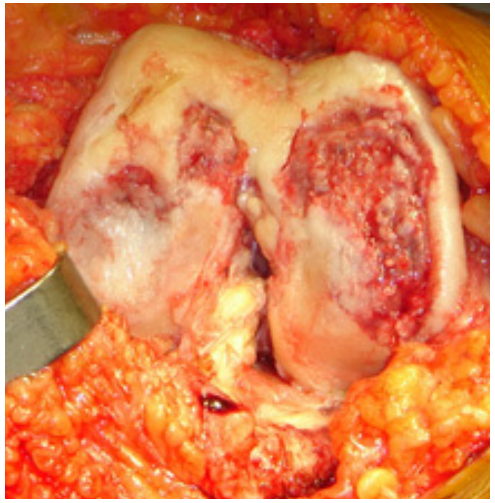
4,2 cm²

4,6 cm²

5,2 cm²

CONTRAINDICATIONS

- Age > 50
- Inability to follow postop protocol
- Diffuse joint degeneration
- Avascular necrosis



RESULTS
Microfractures

Evidence-Based Status of Microfracture Technique:
A Systematic Review of Level I and II Studies

Deepak Goyal, M.B.B.S., M.S.(Orthop), D.N.B.(Orthop), M.N.A.M.S.,
Sohrab Keyhani, M.D.,
Eng Hin Lee, M.D., F.R.C.S.C., F.R.C.S.(Edin), F.R.C.S.(Glasg), F.A.M.S., and
James Hoi Po Hui, M.D., F.R.C.S.(Edin)

Arthroscopy 2013

- 1 to 4 cm^2
- Short term improvement in clinical score

38% failure at 10 years
Better results in younger patients

RESULTS

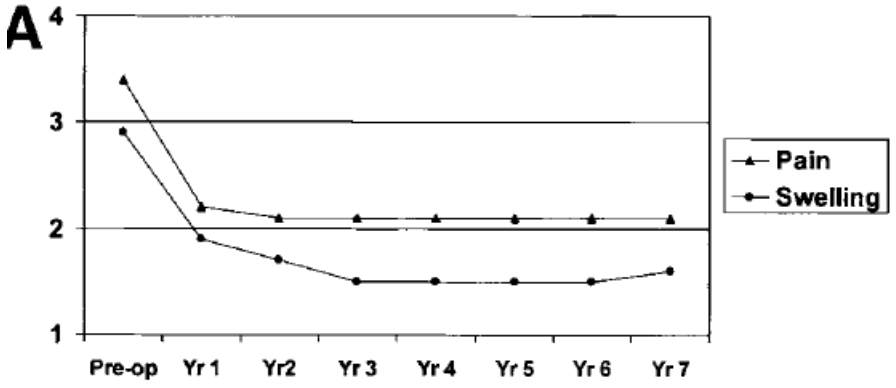
Microfractures

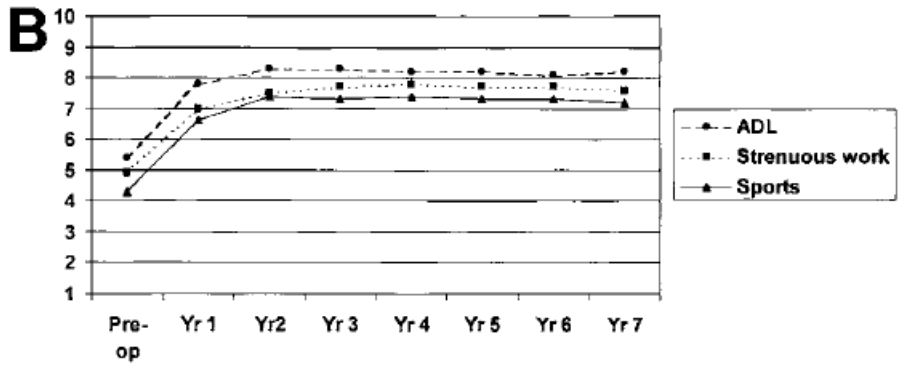
Outcomes of Microfracture for Traumatic Chondral Defects of the Knee: Average 11-Year Follow-up

Arthroscopy 2003

J. Richard Steadman, M.D., Karen K. Briggs, M.B.A., Juan J. Rodrigo, M.D., Mininder S. Kocher, M.D., M.P.H., Thomas J. Gill, M.D., and William G. Rodkey, D.V.M.

- 72 patients 11 years FU
- Improvement in pain and functional scores





Better results patients < 45yo

RESULTS
Microfractures

Long-term results after microfracture treatment for full-thickness knee chondral lesions in athletes

Alberto Gobbi · Georgios Karnatzikos · Anup Kumar

KSSTA 2013

- 61 athletes / 15 years FU
- Deterioration of the clinical outcomes expected at 2 and 5 years

RESULTS
Microfractures

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MFC > LFC

MFC > Patella

RESULTS
Microfractures

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KSSTA 2013

- 61% athletes / 15 years FU
- Deterioration of the clinical outcomes expected at 2 and 5 years

Good long term outcomes in patients <31 Yo with lesions < 400mm²

Degenerative changes: older patients and large lesions

RESULTS

Microfractures vs Mosaïcplasty

Ten-year follow-up of a prospective, randomized clinical study of mosaic osteochondral autologous transplantation versus microfracture for the treatment of osteochondral defects in the knee joint of athletes

Rimtautas Gudas [1], Agne Gudaite, Arnoldas Pocius, Asta Gudiene, Emilis Cekanauskas, Egle Monastyreckiene, Algidas Basevicius

AJSM 2012
Level 1

60 patients, 10 years FU

Failure at final FU

OAT : 14%

MF : 38%

Return to sport at the same level :

OAT : 75%

MF : 37%

RESULTS

Microfractures vs Mosaïcplasty

Osteochondral Autograft Transfer Versus Microfracture in the Knee: A Meta-analysis of Prospective Comparative Studies at Midterm

Ayoosh Pareek [1], Patrick J Reardon [1], Jeffrey A Macalena [2], Bruce A Levy [1], Michael J Stuart [1], Riley J Williams 3rd [3], Aaron J Krych [4]

Arthroscopy 2016

249 patients
67 months FU

OATS > return to sport
OATS lower failure rate

Lesions > 3 cm²

RESULTS

Microfractures vs Mosaïcplasty

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Arthroscopy 2016

249 patients

67 months FU

No difference for lesions < 3 cm^2

RESULTS

Microfractures vs ACI

A randomized trial comparing autologous chondrocyte implantation with microfracture. Findings at five years

Gunnar Knutsen [1], Jon Olav Drogset, Lars Engebretsen, Torbjørn Grøntvedt, Vidar Isaksen, Tom C Ludvigsen, Sally Roberts, Eirik Solheim, Torbjørn Strand, Oddmund Johansen

JBJS 2007

80 patients

5 years FU

Significant improvement in both group

23% failure both group

RESULTS

Microfractures vs ACI

A Randomized Multicenter Trial Comparing Autologous Chondrocyte Implantation with Microfracture: Long-Term Follow-up at 14 to 15 Years

Gunnar Knutsen [1], Jon Olav Drogset [2], Lars Engebretsen [3], Torbjørn Grøntvedt [2], Tom C Ludvigsen [3], Sverre Løken [3], Eirik Solheim [4], Torbjørn Strand [4], Oddmund Johansen [5]

JBJS 2007

No difference between the two groups
32 % failure microFx vs 42% ACI

RESULTS

Microfractures vs Microfractures « plus »

Micro-fragmented stromal-vascular fraction plus microfractures provides better clinical results than microfractures alone in symptomatic focal chondral lesions of the knee

Salvatore Bisic[illegible], Gabriele Bernardi [3], Susanna M Pagnotta [3], Cosimo Tudisco [3]

KSSTA 2020

20 MF vs 20 MF+
FU 12 m
WOMAC
- MF 25,5
- MF+ 17,7

Comparative Clinical Observation of Arthroscopic Microfracture in the Presence and Absence of a Stromal Vascular Fraction Injection for Osteoarthritis

Phu Dinh Nguyen [1], Tung Dang-Xuan Tran [2], Huynh Te[illegible] Nguyen [1], Hieu Trung Vu [1], Phuong Thi-Bich Le [2], Nhan Lu-Chinh Pham [1], Bich Vu [3], Ngoc Kim Phan [3], Phuc Van Pham [3]

Stem Cells Transl Med 2017

15 MF vs 15 MF+
FU 18 m
WOMAC
- MF 37
- MF+ 15

Adipose-Derived Mesenchymal Stem Cells With Microfracture versus Microfracture Alone: 2-Year Follow-up of a Prospective Randomized Trial

Yong-Gon Koh [1], Oh-Ryong Kwon [1], Yong-Sang Kim [1], Yun-Jin Choi [2], Dae-Hyun Tak [1]

Arthroscopy 2016

18 MF vs 26 MF+
FU 24 m

Associated procedures

Short FU
Few patients
↗ Pain & quality of life both groups
Cartilage regeneration ?
Long term OA ?

Take-home Message Microfracture

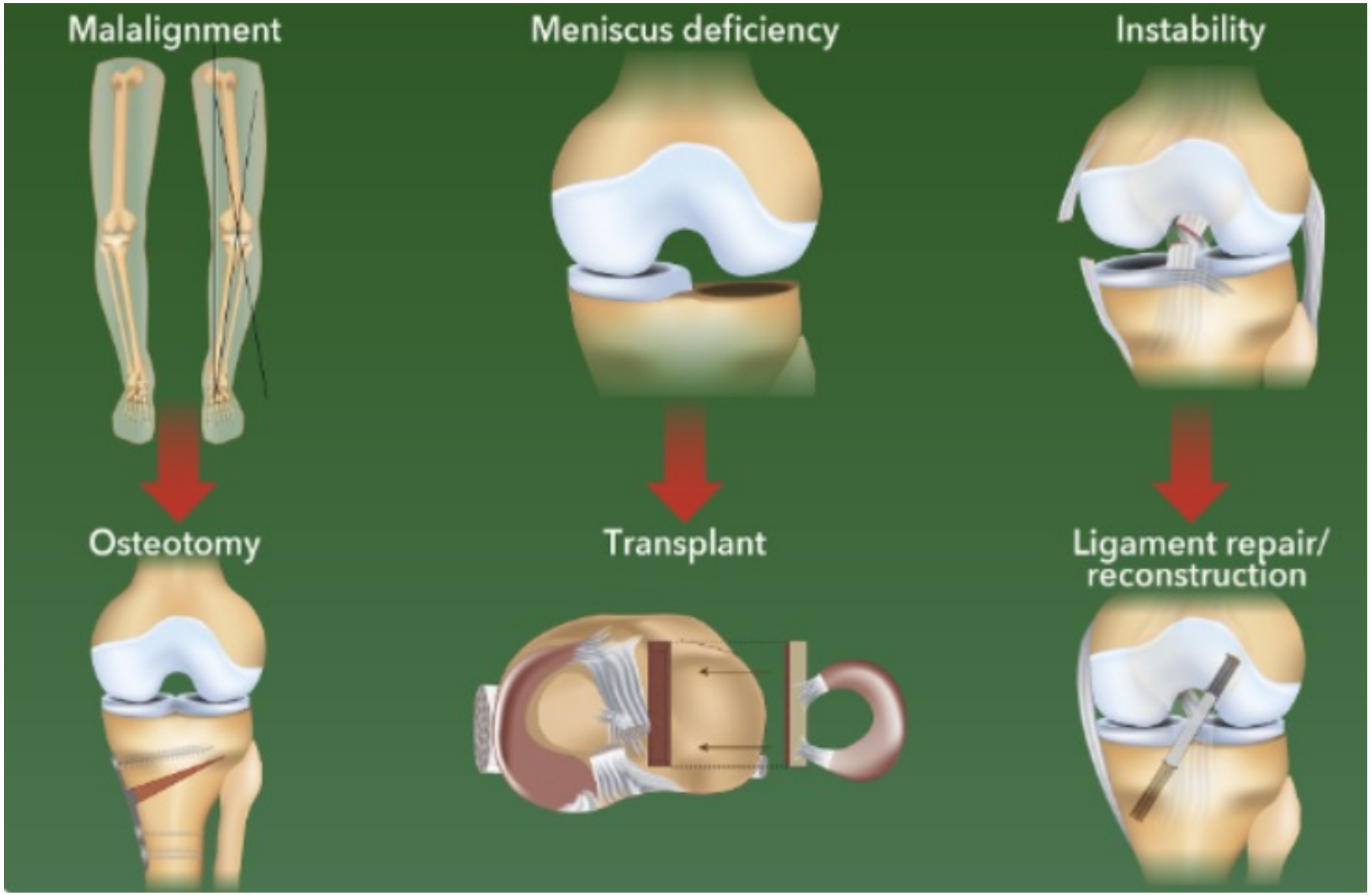
- To considere as a primary treatment for small osteochondral lesion (< 2cm²) in young patients
  - Minimally invasive
  - Not demanding
  - Low cost
  - Low Morbidity

Current Concepts Review

Chondral Lesions of the Knee: An Evidence-Based Approach

MAJ Travis J. Dekker, MD, USAF, MC, Zachary S. Aman, MS, BA, Nicholas N. DePhillipo, PhD, MS, ATC, CSCS, LT COL Jonathan F. Dickens, MD, USA, MC, Adam W. Anz, MD, and Robert F. LaPrade, MD, PhD

ADDRESS COMORBIDITIES



Thank You

www.**centre-orthopedique-santy**.com

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www.lyon-knee-congress.com

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LYON SCHOOL of KNEE SURGERY