

ACI for knee cartilage injuries: Moderate functional outcome and performance in patients with high impact activities



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Introduction

5% to 10% of patients with
hemarthrosis have a focal chondral injury

Noyes FR, et al JBJS, 1980

5%-19% of young individuals
have a grade IV cartilage lesion

Curl WW et al. Arthroscopy, 1997

these lesions can be a
precursor to osteoarthritis

Buckwalter JA. CORR, 2002

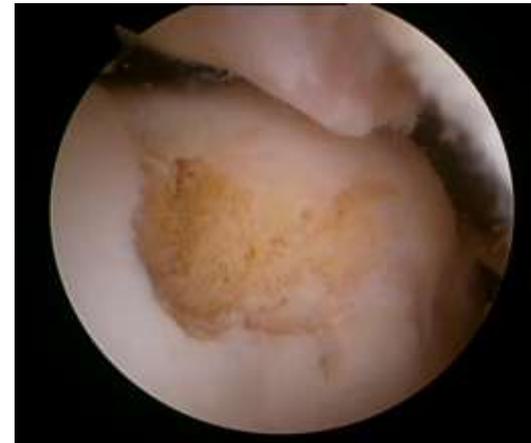
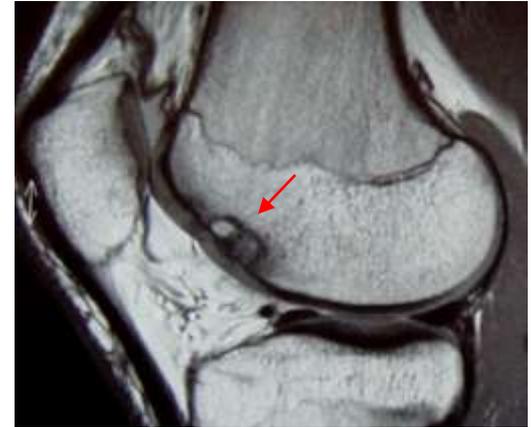


Epidemiology

53,569 hyaline cartilage lesions in 19,827 patients undergoing knee arthroscopy¹

993 consecutive knee arthroscopies demonstrated evidence of articular cartilage abnormality in 66%²

Articular cartilage defects of the femoral condyles in up to 50% of athletes undergoing ACL reconstruction³



1. Curl WW, et al. *Arthroscopy*. 1997
2. Aroen A, et al. *Am J Sports Med*. 2004
3. Piasecki DP, et al. *Am J Sports Med*. 2003

Treatment options

Debridement

Abrasion arthroplasty

Drilling

Microfracture, AMIC

Osteochondral transplantation

Mosaicplasty

Massive allograft

Autologous chondrocyte implantation

MACI

New, one-step biological treatments

Other



Dervin GF, et al JBJS Am, 2003
Steadman JR, et al. Arthroscopy, 2003
Knutsen G, et al. JBJS Am, 2004
Brittberg M, et al. JBJS Am, 2003
Peterson L, et al JBJS Am. 2003

Trends in the surgical treatment of articular cartilage defects of the knee in the United States

Scott R. Montgomery · Brock D. Foster · Stephanie S. Ngo ·
Rodney D. Terrell · Jeffrey C. Wang · Frank A. Petrigliano ·
David R. McAllister

Microfracture and **chondroplasty** 98 % of cases.

There was no significant change in the incidence of cartilage procedures noted from 2004 (1.27 cases per 10,000 patients) to 2009 (1.53 cases per 10,000 patients) ($p = 0.06$).

Autologous chondrocyte implantation

“Classic” ACI

Success rate up to 90% after 10 years follow-up

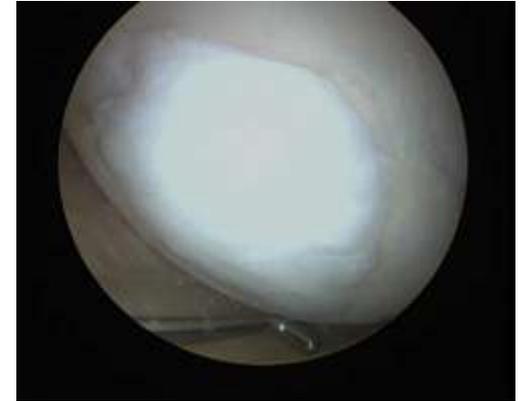
Long term durability

Gold-standard if previous treatment failed

Minas T, et al. Clin Sports Med, 1999

Peterson L, et al. Clin Orthop, 2000

Smith GD et al. JBJS Br, 2005



Matrix-assisted ACI

Mini arthrotomy

Shorter operative time?

Less graft-related complications?



Bartlett W, et al. JBJS Br, 2005

Haddo O, et al. Knee, 2004

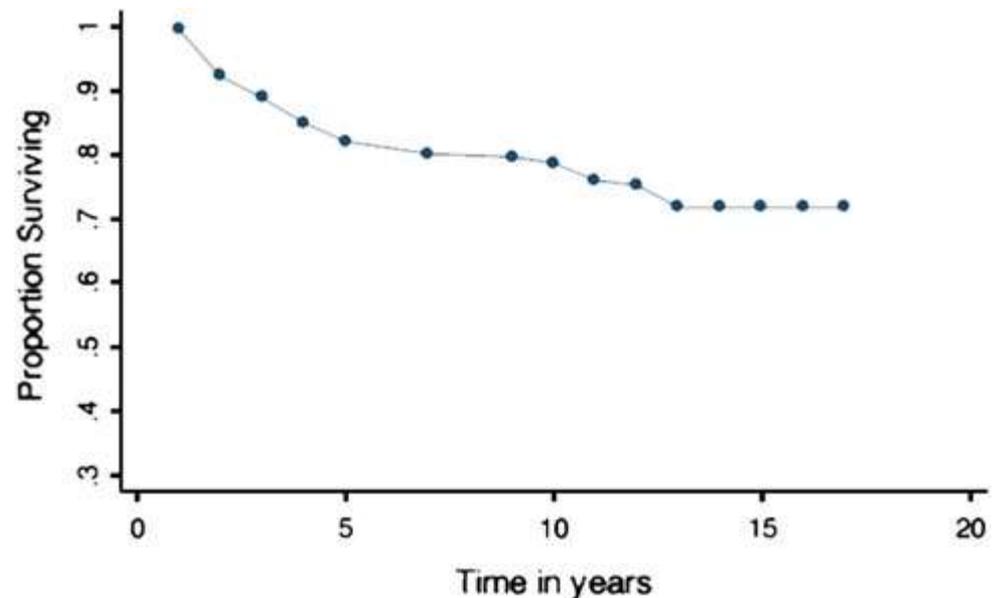
The John Insall Award

A Minimum 10-year Outcome Study of Autologous Chondrocyte Implantation

Tom Minas MD, MS, Arvind Von Keudell MD,
Tim Bryant RN, Andreas H. Gomoll MD

At a mean of 12 ± 2 years follow up, 53 of 210 patients (**25%**) had at least one failed ACI graft

age younger than 45 years,
defect sizes less than 15 cm^2 ,
no prior microfracture,
concomitant HTO



ACI in high demand patients?

72% good to excellent overall results in 45 professional and recreational soccer players.

Mithöfer K, Peterson L, et al. Am J Sports Med, 2005

96% excellent results in 20 adolescents athletes
96% of them returned to high-impact sports

Mithöfer K, Minas, et al Am J Sports Med, 2005



Treatment of Chondral Defects in the Athlete's Knee

Arthroscopy Vol 26, No 6 (June), 2010: pp 841-852

Joshua D. Harris, M.D., Robert H. Brophy, M.D., Robert A. Siston, Ph.D., and
David C. Flanigan, M.D.

Improved outcomes (especially after ACI)

Defect size < 2 cm²,

preoperative duration of symptoms < 18 months,

no prior surgical treatment,

younger patient age,

and higher preinjury and postsurgical level of sports

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

abstract

Full article available online at ORTHOSuperSite.com. Search: 20111122-07

Few studies have assessed the results of autologous chondrocyte implantation in patients with high-impact activities. The purpose of this study was to evaluate the early functional outcome and activity level after 2-stage autologous chondrocyte implantation in professional soldiers and athletes. Nineteen patients with an average age of 32.2 years were treated with autologous chondrocyte implantation and followed up for a minimum of 2 years. All patients except 2 had received previous arthroscopic treatment with debridement and/or microfracture. The mean size of the postdebridement defect was 6.54 cm². Using Novocart technology (B. Braun-Tetec, Reutlingen, Germany), periosteal patch and matrix-assisted autologous chondrocyte implantation was sequentially performed with



Material (19 patients)

12 professional soldiers

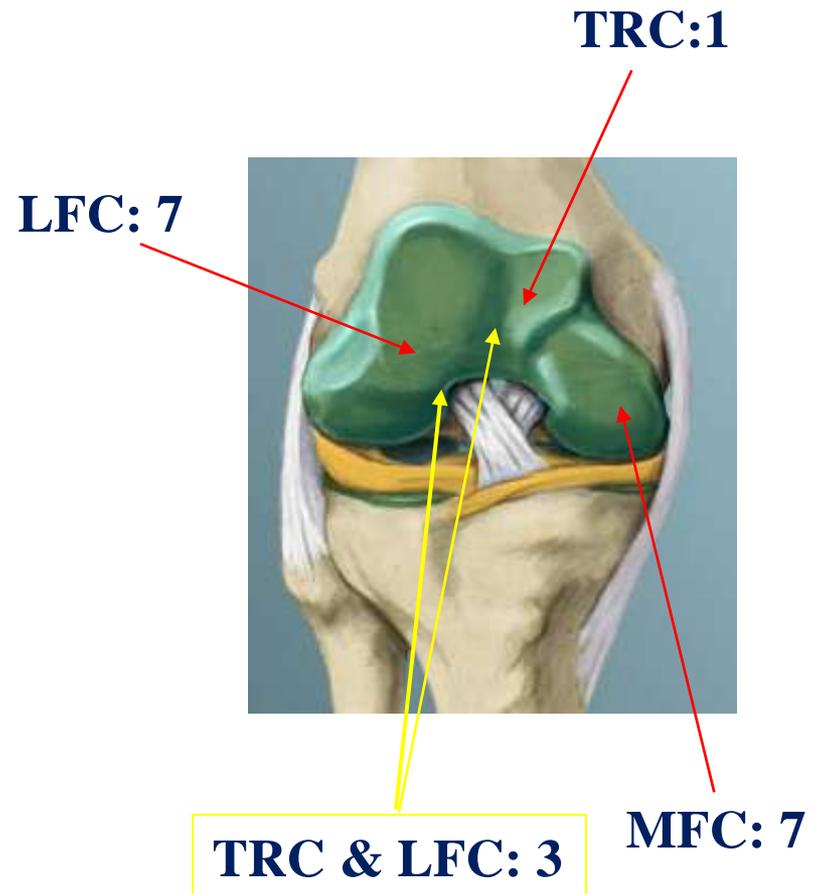
5 professional athletes,

2 recreational athletes

male :15 – female: 4

average age **31** years

22 defects (ICRS grade-IV)



Material (19 patients)

Mean duration of symptoms **43.8** months

Average defect size was **6.03 cm²** (4.5-15 cm²)

73% at least 1 previous arthroscopy

(5 failed micro#, 1 failed OCD fixation)

4 patients bone graft (depth > 7mm)

minimum follow up **36** months



Secondary lesions = Grade I & II

Patella	3	} debridement
Plateau	1	

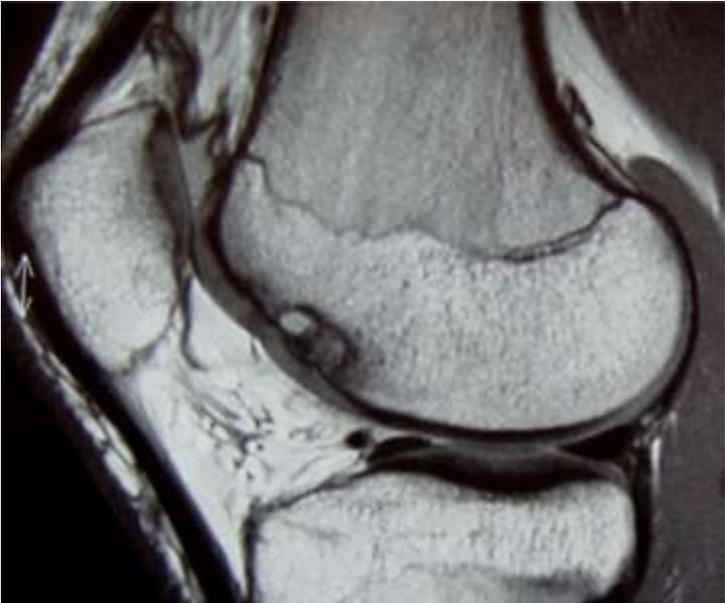
Complex injuries

ACL 3 (previous stage reconstruction)

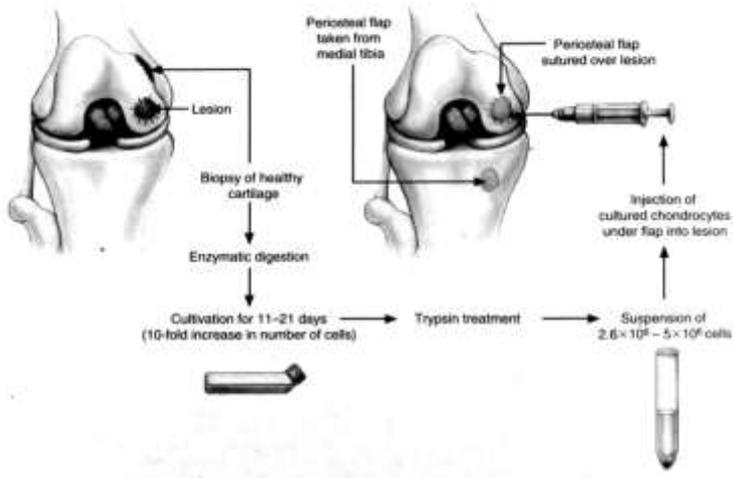
Menisci 5 (same stage reconstruction)



Preoperative Evaluation

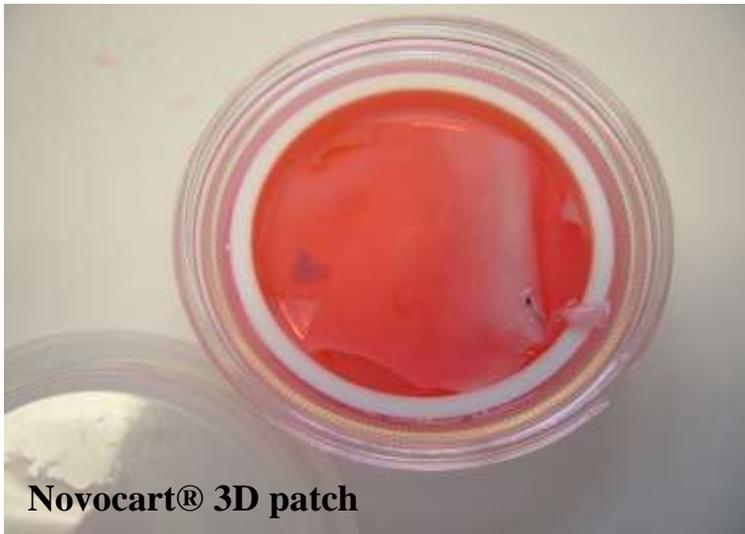


Surgical technique



N=11

Brittberg M et al. *N Engl J Med*, 1994



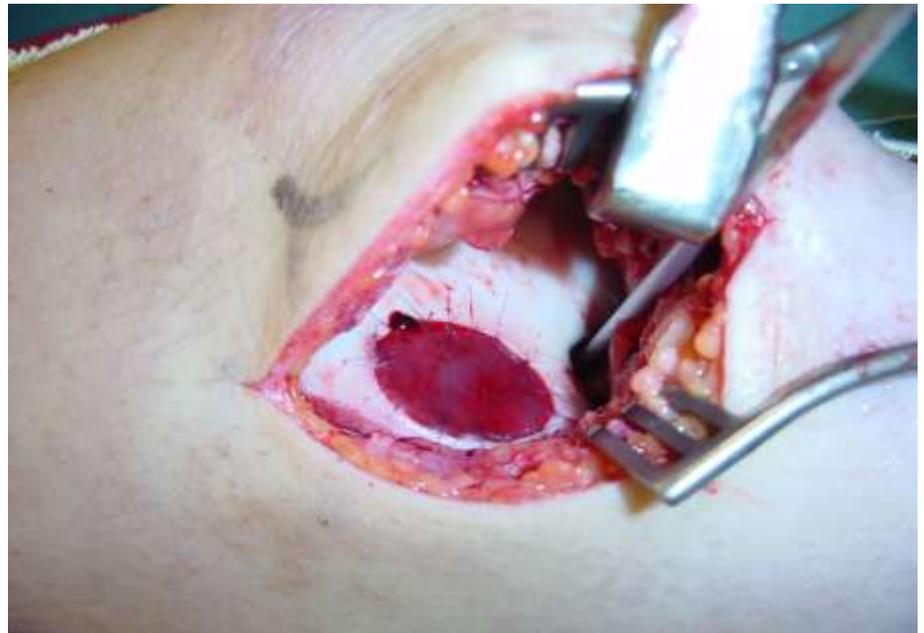
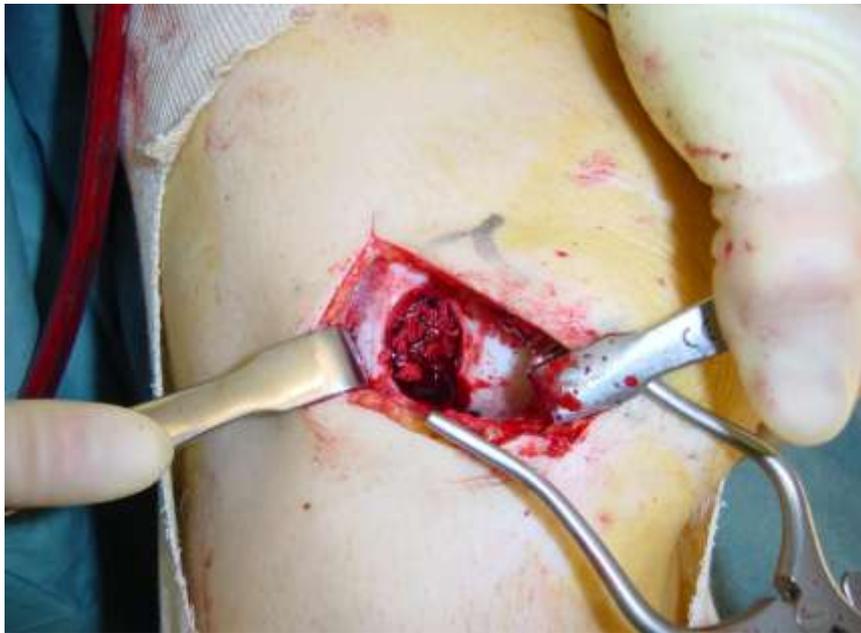
Novocart® 3D patch



N=8

Fritz C, et al. *Zentralbl Chir* 2005

Surgical technique



Clinical evaluation

Cartilage Injury Evaluation Package - ICRS

ICRS injury questionnaire

IKDC subjective knee evaluation form-2000

Lyshom score

Tegner activity scale

Table 2

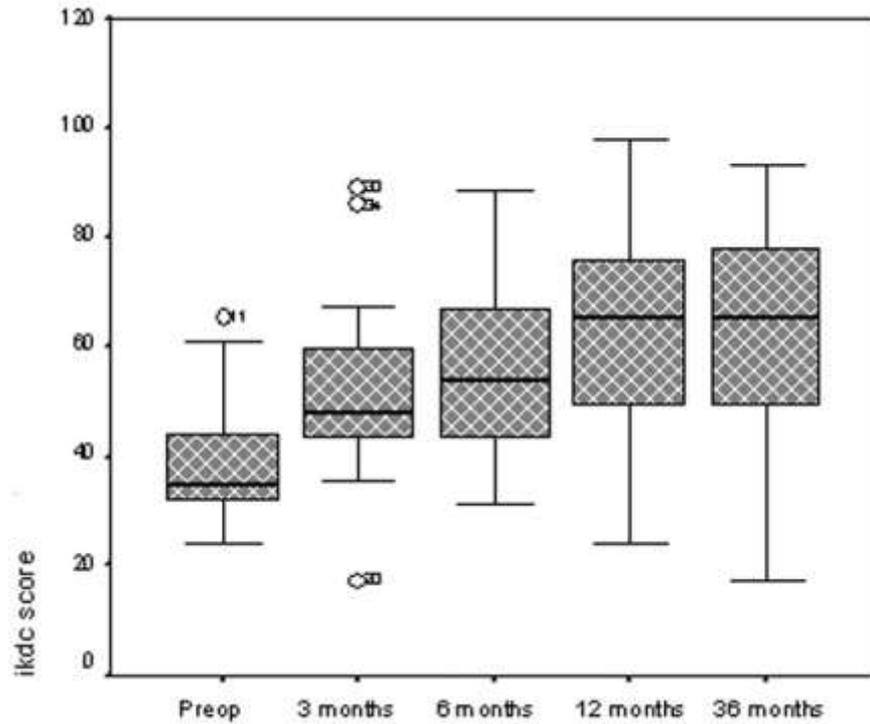
Overall Functional and Clinical Outcome

Patient No.	IKDC Score		Functional Status			Tegner Scale			Lysholm Score	
	Preop	FU	PRI	Preop	FU	PRI	Preop	FU	Preop	FU
1	43.6	63.2	I	II	III	9	3	6	53	58
2	60.9	86.2	I	III	II	10	3	8	45	74
3	44.8	49.4	II	III	III	7	4	5	33	61
4	34.4	40.2	I	II	III	9	4	6	44	67
5	31.0	54.0	I	II	III	10	5	5	32	51
6	42.5	93.1	I	III	I	10	4	8	47	90
7	24.1	40.2	I	II	III	9	3	6	39	48
8	32.1	66.6	II	II	III	9	3	7	38	74
9	43.6	75.8	I	III	II	10	4	7	39	78
10	49.4	79.3	I	III	II	9	3	7	49	88
11	26.4	35.5	I	III	IV	9	3	4	32	40
12	32.1	58.6	I	III	II	8	3	6	40	69
13	49.4	58.6	I	IV	III	8	5	7	44	65
14	35.6	39.0	I	III	II	9	4	6	37	62
15	33.3	73.5	I	III	II	7	3	5	42	84
16	33.4	57.4	I	III	III	8	4	7	37	65
17	65.5	82.7	I	III	II	9	4	6	63	90
18	33.3	59.7	I	III	II	7	4	5	38	79
19	28.7	73.5	I	III	II	9	3	6	54	76

Abbreviations: FU, follow-up; IKDC, International Knee Documentation Committee; Preop, preoperatively; PRI, preinjury.

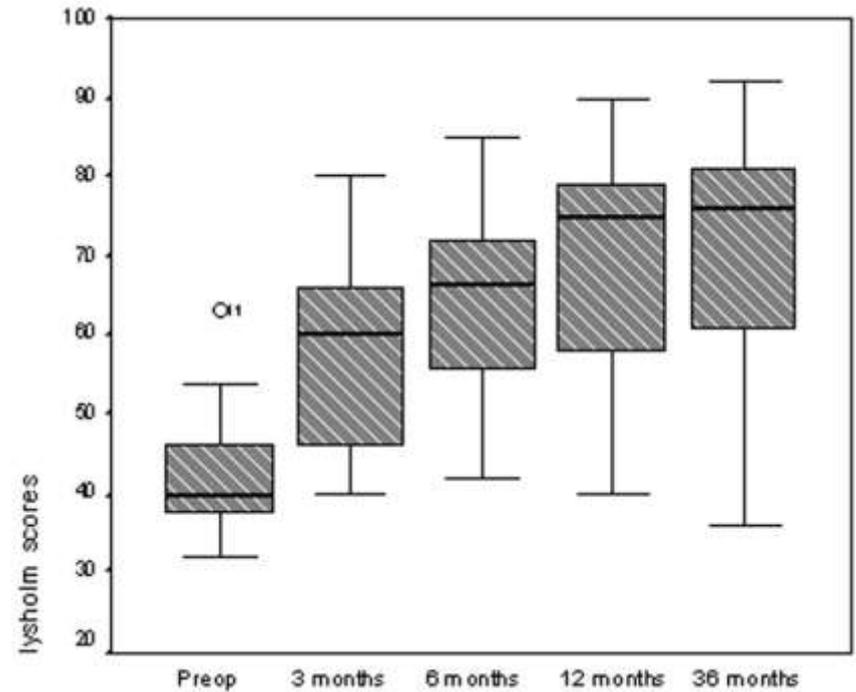
Results

IKDC



prop 39.16 post 62.4

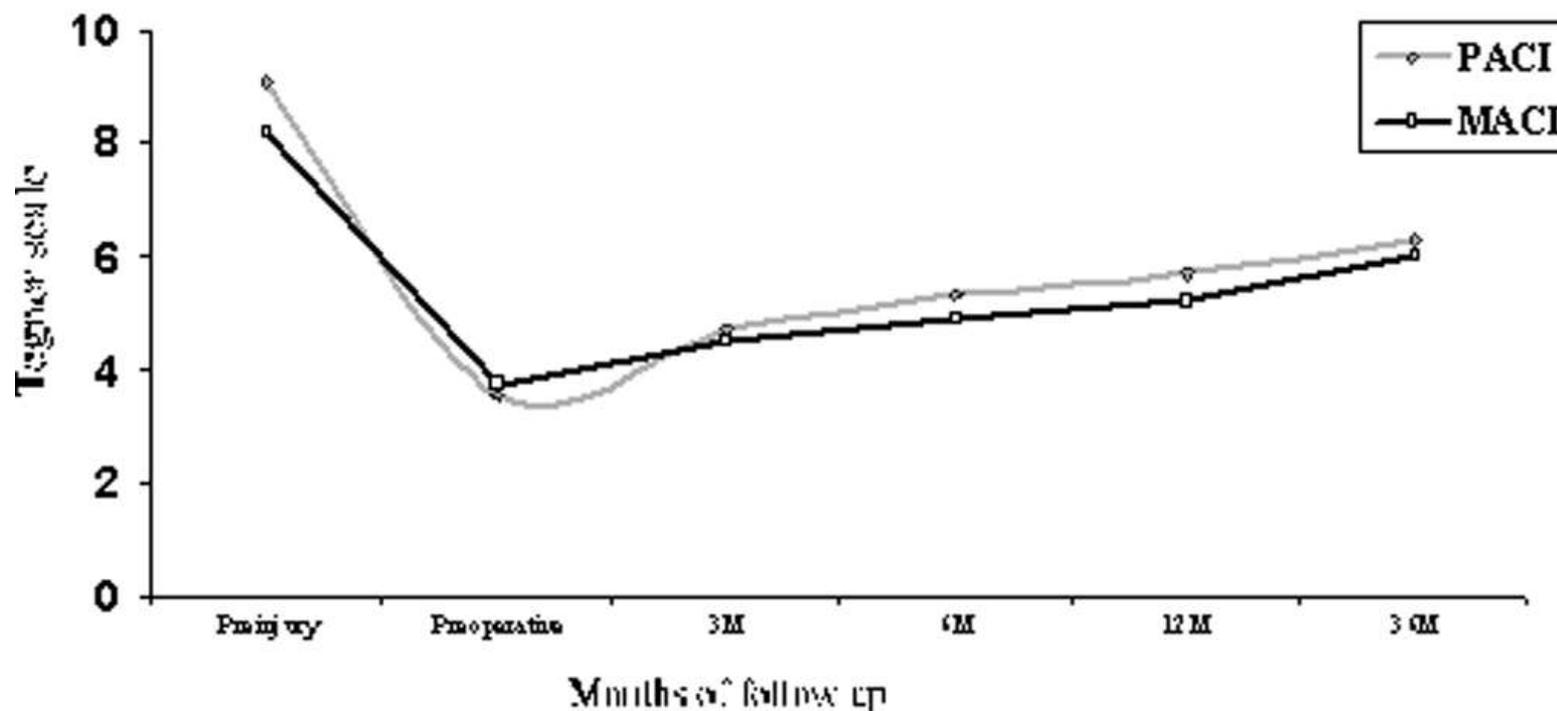
Lyshom score



prop 42.42 Post 69.4

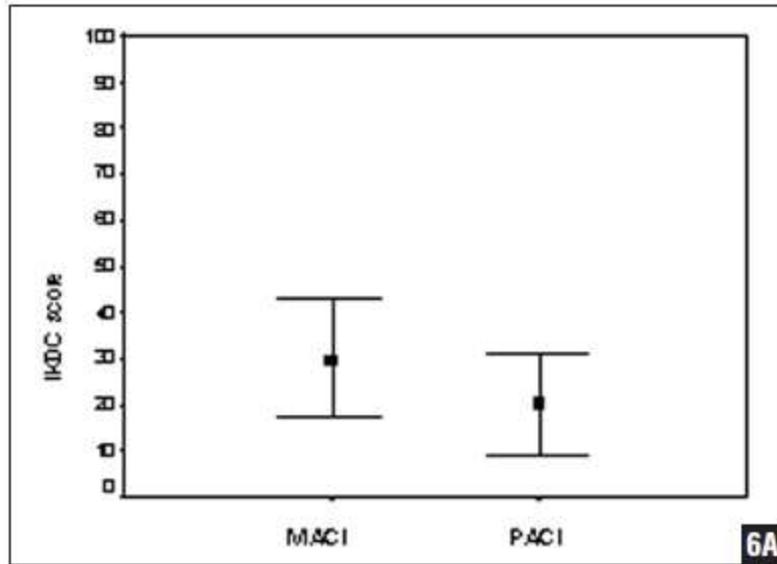
Results

Median Tegner activity score was **8.8** before injury, **3.8** preoperatively, and **6.15** at latest follow-up.

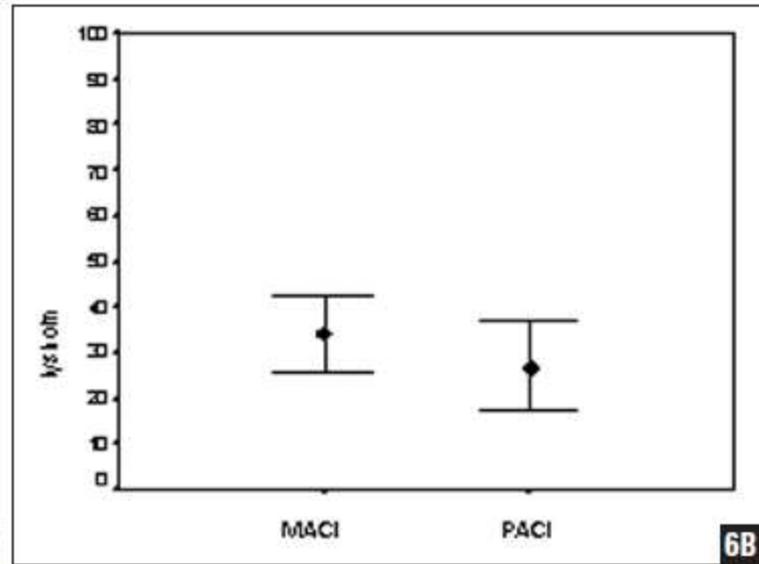


Results

Change in IKDC & Lysholm score , pre-op to 36 months, in the two groups



IKDC



Lyshom

Return to heavy duties/sport (19 pt)

1 prof. footballer → same level

1 semi-prof. rugby player

3 significant lower level of performance

1 soldier only P2 level (fit for full service)

8 were classified as P3 (able for light duties only)

2 as P7 (still under medical care)

1 left the army untimely (P8, medically discharged).



PULHHAEEEMS, UK Army: fitness performance test

Only 6/19 patients (31%) return to pre-injury level of performance

Complications

2 patients arthrofibrosis

11/19 pt (57.8%) 2nd look arthroscopy

- persistent pain
- decreased range of motion
- mechanical symptoms

1 patient complete delamination of the central area (2.0 x 2.0 cm²) of the graft

overgrowth of the graft (5 cases)

patch detachment (1 patient)

unstable periosteal edges (2 patients)

softened spots (2 patients)



Conclusions

In high-demand patients who have long standing disability, large defects and failed previous cartilage techniques the results of ACI might not be as good as it is usually is reported or expected

An overall improvement in knee function can always be achieved but from this point of view, ACI can be only be defined as a salvage solution than a fundamental and life style procedure

Conclusions

The quality of cartilage restoration studies is poor, and heterogeneity exists regarding the techniques followed, the included populations, and the reported outcomes.

The results of randomized and well-designed prospective studies may give more specific answers in the future. Until then, ACI implantation must prove its superiority, especially in the high-demand population.

Conclusions

Ideal candidate for ACI is a

young and fit patient with

high preoperative functional scores, and

no previous operations, who is

less than 12 months symptomatic, and

has an isolated and moderate-sized cartilage defect