Türkiye Spor Yaralanmaları Artroskopi ve Diz Cerrahisi Derneği
Turkish Society of Sports Traumatology Arthroscopy and Knee Surgery

AKUT ÖÇB YARALANMALARI TEDAVİSİNDE BİYOLOJİK TEDAVİ EKLENTİLERİ

Dr. Haluk H. Öztekin
2024

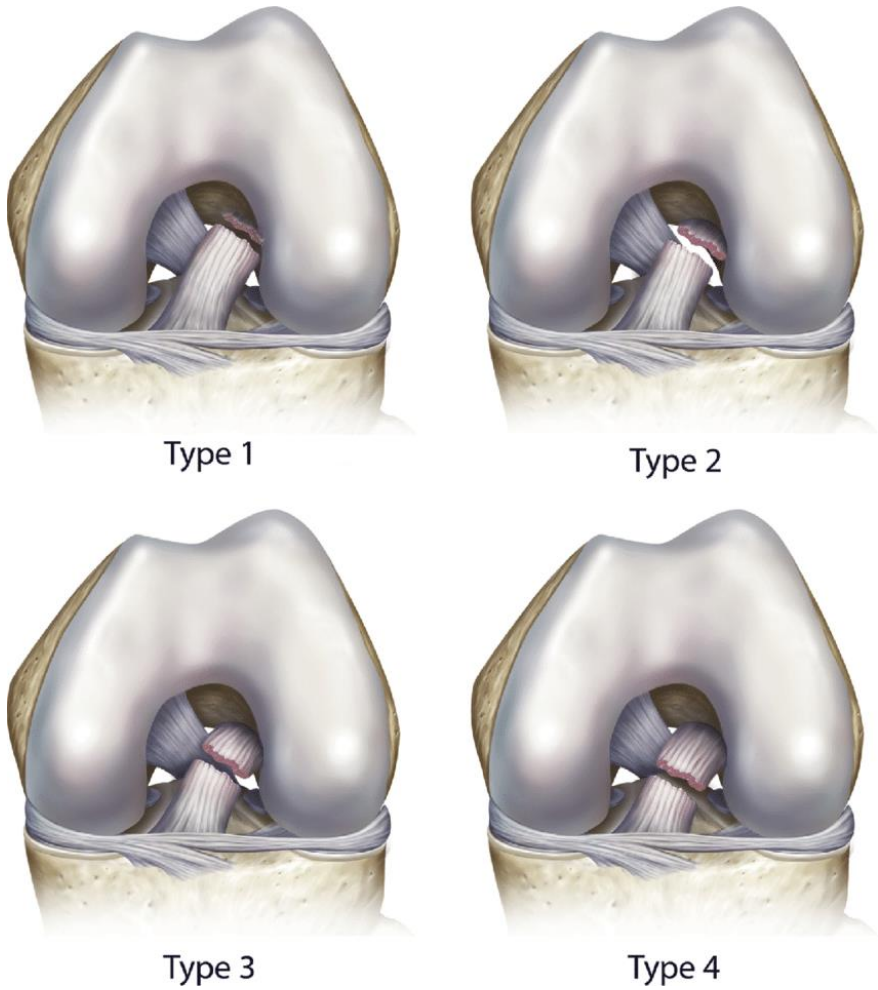
ÖÇB YARALANMALARI HAKKINDA Bildiklerimiz:

- ÖÇB yaralandığında, spontan iyileşme potansiyeli çok zayıftır.
- Parsiyel yaralanmaların % 50 si zaman içinde tam kopmaya dönüşür(Noyes, *JBJS*).
- ÖÇB yoksunluğunda en iyi tedavi seçeneği rekonstrüksiyondur, ancak başarı max. % 80 dir.
- ÖÇB-R dezavantajları: a. Donör saha morbiditesi b. Donör adalelerin zayıflığı c. Azalmış derin propriyosepsiyon d. Spora dönüş yapamama.

Gobbi, *AJSM.*

ÖÇB KOMPLET YARALANMALARI

SHERMAN sınıflaması(1991)



AKUT ÖÇB parsiyel YARALANMALARI-SINIFLAMA Gobbı, *Tech Orthop,* 2013.

- Tip I AM demet parsiyel(<%100)
- Tip II PL demet parsiyel(<%100)
- Tip III Her 2 demet parsiyel
- Tip IV Komplet

Orthopaedics & Traumatology: Surgery & Research 102 (2016) S59–S67

Available online at ScienceDirect www.sciencedirect.com

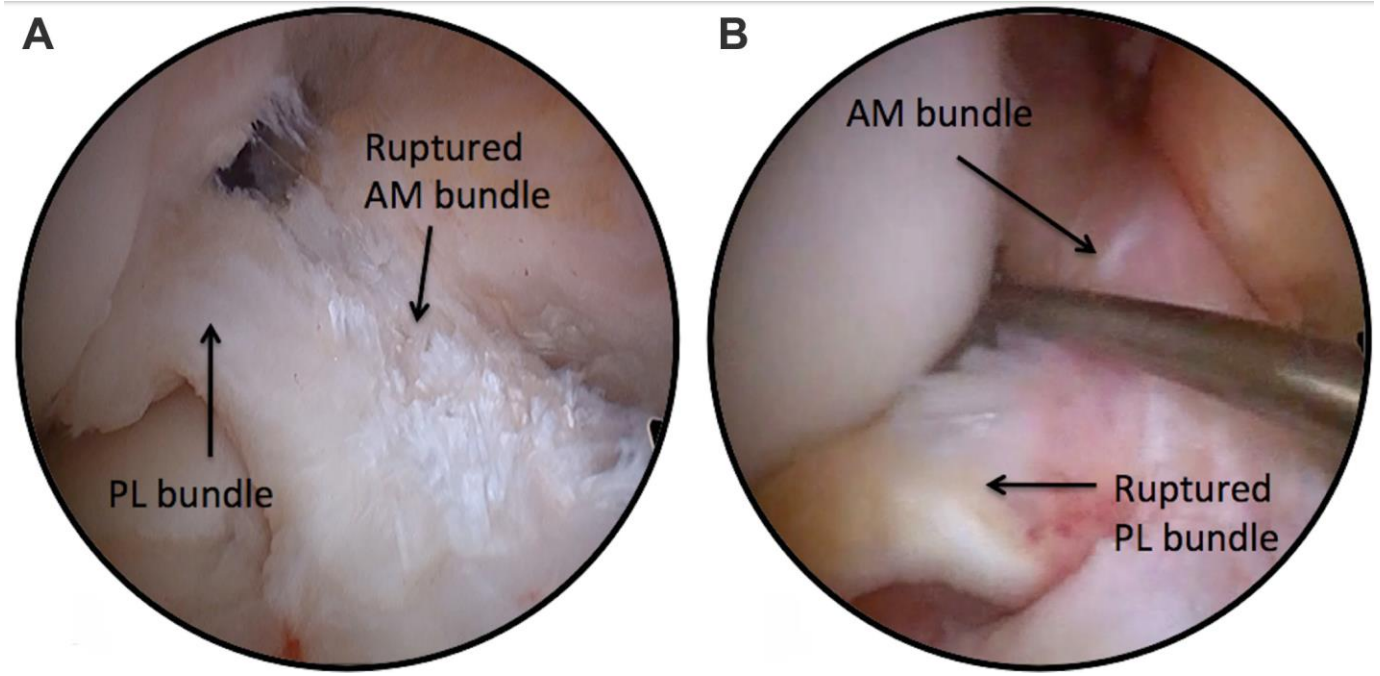
Elsevier Masson France EM|consulte www.em-consulte.com/en

Review article

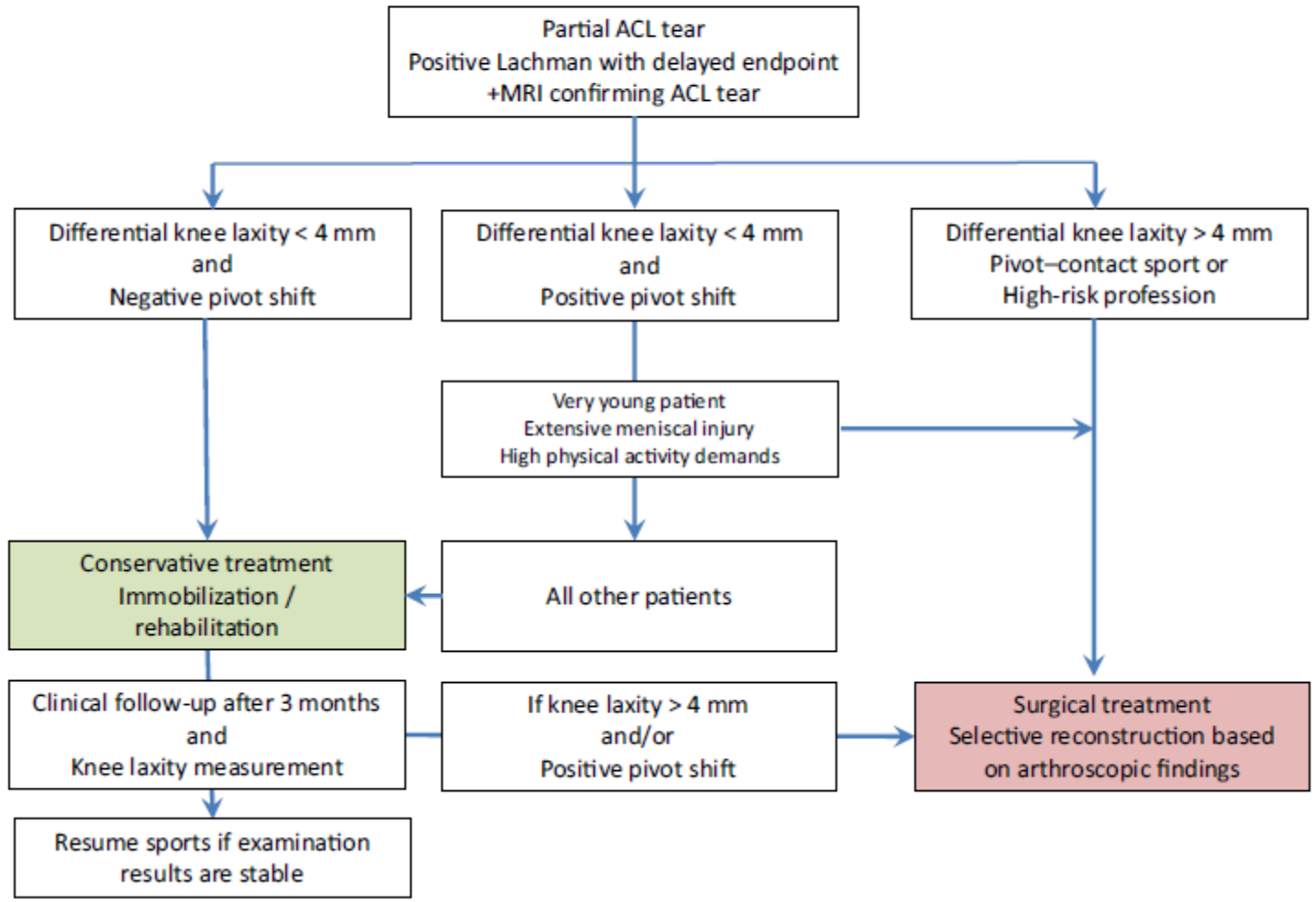
Partial tears of the anterior cruciate ligament

B. Sonnery-Cottet[a,*], P. Colombet[b]

[a] *Générale de santé, hôpital privé Jean-Mermoz, centre orthopédique Santy, 24, avenue Paul-Santy, 69008 Lyon, France*
[b] *Clinique du Sport, 2, rue Negrevergne, 33700 Merignac, France*



FLOW CHART FOR PARTIAL ACL TEARS



Clin Orthop Relat Res (2012) 470:979–985
DOI 10.1007/s11999-011-1933-8

SYMPOSIUM: ARTHROSCOPY

Spontaneous Healing in Complete ACL Ruptures

A Clinical and MRI Study

Matias Costa-Paz MD, Miguel Angel Ayerza MD, Ignacio Tanoira MD, Juan Astoul MD, Domingo Luis Muscolo MD

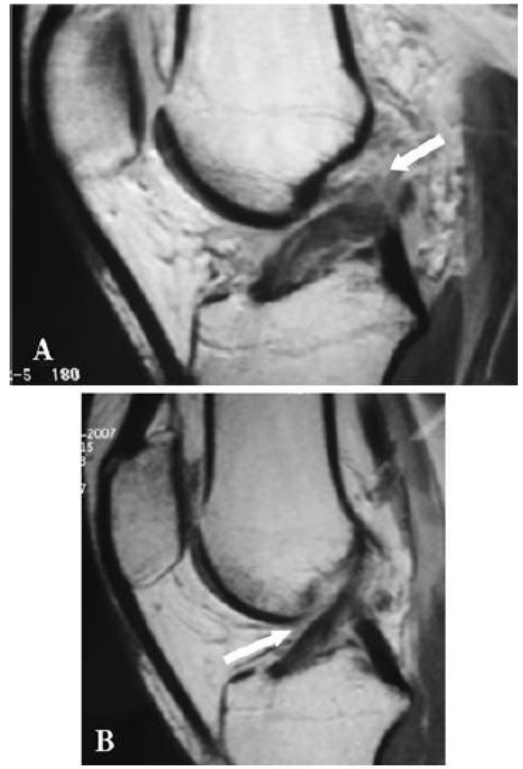


Table 2. Results of clinical evaluation of patients at a minimum of 2 years after ACL rupture

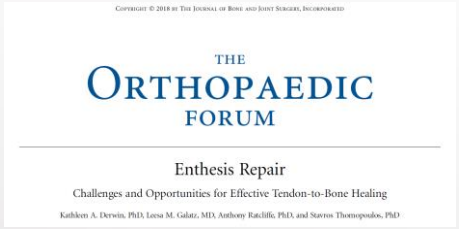
Patient	First evaluation		Second evaluation			Test			
	MRI ACL tear	Lachman test	Pivot test	Lachman test	Pivot test	KT-1000™ (mm)	Tegner-Lysholm activity level (initial/final)	Lysholm-Gillquist score (points)	IKDC
1	Proximal	Severe	Jump	Negative	Negative	1.5	6/7	91	A
2*	Proximal	Severe	Jump	Negative	Negative	3	6/7	100	A
3	Middle	Severe	Jump	Negative	Negative	3	7/7	100	A
4	Middle	Moderate	Glide	Negative	Negative	3.5	6/7	95	B
5	Proximal	Severe	Jump	Negative	Negative	2.6	6/7	95	B
6	Proximal	Moderate	Glide	Negative	Negative	1	7/7	100	A
7*	Middle	Severe	Jump	Negative	Negative	2.2	6/7	96	A
8	Middle	Severe	Jump	Negative	Negative	2	7/7	100	A
9	Proximal	Severe	Jump	Negative	Negative	2	7/7	95	A
10	Proximal	Severe	Jump	Negative	Negative	2	7/7	100	A
11	Middle	Moderate	Glide	Mild	Negative	1	6/7	90	B
12	Proximal	Severe	Jump	Negative	Negative	1	7/7	100	A
13	Proximal	severe	Glide	Negative	Negative	2	6/7	95	B
14	Middle	Moderate	Jump	Negative	Negative	1	6/7	100	A

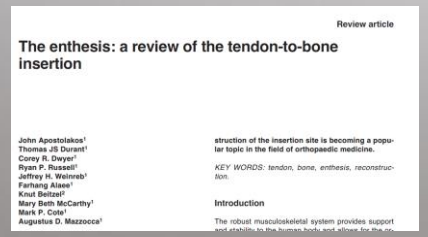
* Patients who suffered a rerupture of the ACL after the study period; IKDC = International Knee Documentation Committee Subjective Knee Evaluation Form; A = normal; B = nearly normal.

showed an end to end continuous ACL with homogeneous signal. The Tegner-Lysholm activity level remained the same in seven patients and declined in seven. At 2.5 years after the lesion, two patients suffered a rerupture of the ACL, requiring an arthroscopic reconstruction.

natural evolution and spontaneous healing of this lesion with clinical and imaging followup. The spontaneous healing of the complete ACL rupture persisted in 12 patients without using an extension brace, and they were able to continue with their athletic activity.

Entezis terimi





- Eklem içi Entezis: Rotator manşet, Flexor tendon, ÖÇB, meniskal root
- Eklem dışı Entezis: Aşil, patellar tendon, MCL.
- Fibröz (metafiz ve diafize yapışır, e.g. Deltoid)
- Fibrokartilajinöz (epifiz ve apofize yapışır)

Knee Surg Sports Traumatol Arthrosc (2017) 25:493–500
DOI 10.1007/s00167-016-4172-4

KNEE

Long-term follow-up of isolated ACL tears treated without ligament reconstruction

Thomas L. Sanders[1] · Ayoosh Pareek[1] · Hilal Maradit Kremers[1,2] · Andrew J. Bryan[1] · Bruce A. Levy[1] · Michael J. Stuart[1] · Diane L. Dahm[1] · Aaron J. Krych[1]

Methods This study compared a population-based incidence cohort of 364 patients with new-onset, isolated ACL tears between 1990 and 2000, to an age and sex-matched cohort of 364 individuals without ACL tears. A chart review was performed to collect information related to the initial injury, treatment, and outcomes. Subjects were retrospectively followed for mean follow-up of 14.3 years (±7.4 years) to determine the development of subsequent meniscal injury, arthritis, or total knee arthroplasty (TKA).

Patients treated non-operatively after isolated ACL tears are at a significantly higher risk of secondary meniscal tears, osteoarthritis, and TKA when compared to age and sex-matched subjects without ACL tears. Baseline lateral meniscal tears were associated with an increased risk arthritis and TKA. The results of this study can be used to

Intrinsic Healing Response of the Human Anterior Cruciate Ligament: An Histological Study of Reattached ACL Remnants

Duy Tan Nguyen,[1] Tamara H. Ramwadhdoebe,[2] Cor P. van der Hart,[3] Leendert Blankevoort,[1] Paul Peter Tak,[2] Cornelis Niek van Dijk[1]

[1]Department of Orthopedic Surgery, Orthopaedic Research Center Amsterdam, Academic Medical Center, University of Amsterdam, 1100 DD, Amsterdam, The Netherlands[2]Division of Clinical Immunology and Rheumatology, Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands[3]Bergman Clinics, Naarden, The Netherlands

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Published online 5 November 2013 in Wiley Online Library (wileyonlinelibrary.com). DOI 10.1002/jor.22511

ABSTRACT: A reattachment of the tibial remnant of the torn anterior cruciate ligament (ACL) to the posterior cruciate ligament is sometimes observed during surgery and apparently implies that the human ACL does have a healing response. The aim of this study was to investigate whether this reattachment tissue has similar histological characteristics of a healing response as the medial collateral ligament (MCL), which can heal spontaneously. Standard histology and immunostaining of α-smooth muscle actin and collagen type 3 was performed. The results shows that the reattached tissue has typical characteristics of a healing response: the reattached ACL remnant could not be released by forceful traction; microscopy showed that the collagen fibers of the reattached tissue were disorganized with no preferred direction; increased neovascularization; the presence of lipid vacuoles; the mean number of cells within the biopsy tissue was 631 ± 269 cells per mm^2; and $68 \pm 20\%$ was expressing α-SMA; semi-quantitative analysis of collagen type 3 expression showed that collagen type 3 had an high expression with an average score of 3. In conclusion, this study shows that the human proximal 1/3 ACL has an intrinsic healing response with typical histological characteristics similar to the MCL. © 2013 Orthopaedic Research Society. Published by Wiley Periodicals, Inc. J Orthop Res 32:296–301, 2014.

Keywords: anterior cruciate ligament; healing response; primary repair; remnant; human

In conclusion, this study shows that the human proximal 1/3 ACL has an intrinsic healing response with typical characteristics similar to the MCL that can heal spontaneously. Combined with the recent findings of ACL healing in animal models there is sufficient support to warrant future translational studies to develop and evaluate the bio-enhanced suture repair of torn ACL in humans.

ÖÇB PARSİYEL YARALANMALARININ TEDAVİSİNE BİYOLOJİK YAKLAŞIM Dallo, *OJSM,* 2017.

1. MİKROFRAKTÜR (KEMİK İLİĞİ STİMÜLASYONU)
2. GF
3. PRP/ACP®/Orthokıne®
4. Kök hücre
5. Biyolojik skafoldlar

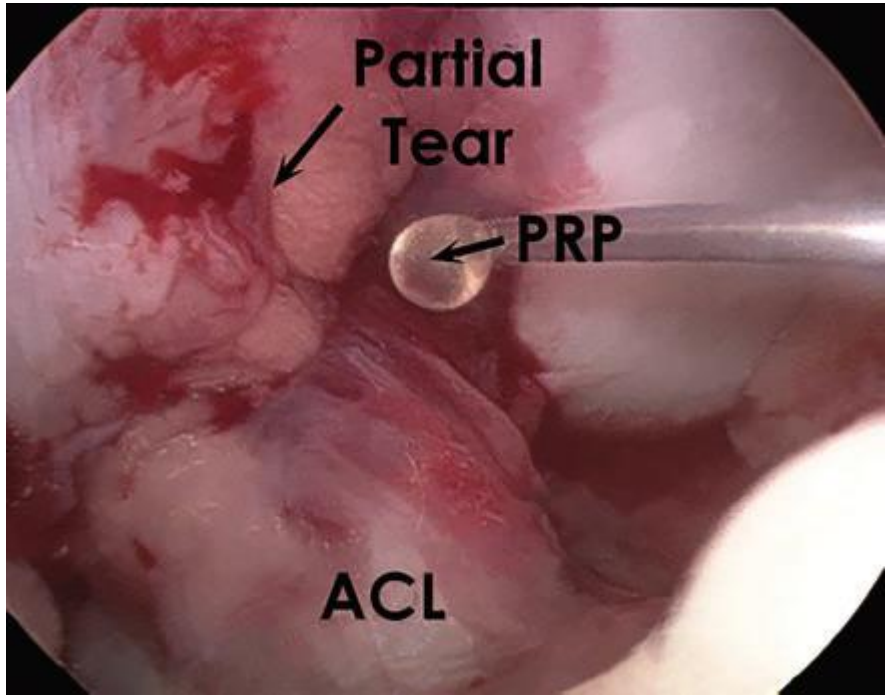
Review

Biologic Approaches for the Treatment of Partial Tears of the Anterior Cruciate Ligament

A Current Concepts Review

Ignacio Dallo,* MD, Jorge Chahla,† MD, Justin J. Mitchell,† MD, Cecilia Pascual-Garrido,‡ MD, John A. Feagin,† MD, and Robert F. LaPrade,†§‖ MD, PhD

Investigation performed at the Steadman Philippon Research Institute, Vail, Colorado, USA



LaPrade, *OJSM,* 2017

Biyolojik tedavide EN SIK KULLANILANLAR

- PRP(Trombositten zengin plazma: Lökositden zengin/fakir)
- ACP® (Otolog şartlandırılmış serum) ve SİTOKİNLER
- PRGF(Trombositten zengin büyüme faktörü)
- MSC (Mezenşimal kök hücre: Orijin>Kemik iliği, Yağ dokusu, Synovial doku)
- BEAR (Bridge-enhanced ACL repair>Extrasellüler matriks içeren sığır kollajeni: Biyoaktif skafold+otolog kan. Martha Murray)
- Exosome+PRP

«SCIENCE FICTION» veya «SCIENCE FACT»?
«JUNK SCIENCE» or «SCIENTIFIC»?

SORU: Kanıta dayalı veya hayvan deneyi çalışmaları var mı?
CEVAP: RKÇ yok, Sistematik ve kanıt seviyesi IV ile laboratuvar çalışmaları var.

McIntyre et al, *AJSM* 2018: Intra-articular Mesenchymal Stem Cell Therapy for the Human Joint: A Systematic Review

Mevcut klinik çalışmalar

ÖÇB tamiri+MF	Steadman 2006	13 hasta	%23 re-injury
	Gobbi 2009	26 hasta	%81 başarı
	Wasmaier 2013	48 hasta	Kons. ted. ile farkı yok
ÖÇB tamiri+GF	Klinik çalışma yok		
ÖÇB tamiri+PRP	Seijas 2014	19 hasta	%5 re-injury
ÖÇB tamiri+MSCs	Centeno 2015	10 hasta	%86,7 spora dönüş
Skafold+sütür+PRP	Gobbi 2013	58 hasta	%78 spora dönüş
B.E.A.R	Murray2016	20 hasta	Sonuçlar Hamstring ÖÇBR ile aynı

Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology 14 (2018) 10–16

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Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology

journal homepage: www.ap-smart.com

Review Article

The non-reconstructive treatment of complete ACL tear with biological enhancement in clinical and preclinical studies: A systematic review

Yue Li [a], Sai Cheun Fu [b, c], Yau Chuk Cheuk [b, c], Guanyang Song [a], Hua Feng [a], Shu-Hang Yung [b, c, *]

[a] Sports Medicine Service, Beijing Jishuitan Hospital, China
[b] Department of Orthopaedics and Traumatology, Faculty of Medicine, The Chinese University of Hong Kong, China
[c] Lui Che Woo Institute of Innovative Medicine, The Chinese University of Hong Kong, Hong Kong, China

Summary of clinical studies.

Study	Study design	Patients included	M:F	Average age, yr	Mean F/U, mo	Bio-enhancement techniques	Surgical procedure on ACL	Rate of reoperation	Assessment of outcome	MINORS
Steadman et al.[2]	Case series	13	9:4	13	69	Bone marrow stimulation	ACL perforation	23.1%	Instrumented SSD: 5 (3–10)mm Lysholm: 96, Tegner: 8.5	11
Steadman et al.[16]	Case series	48	13:35	51	91.2	Bone marrow stimulation	ACL perforation	8.9%	More than 90% lower than Lachman Grade 3 Lysholm: 90, Tegner: 5	10
Wasmaier et al.[17]	Case series	28	20:10	30.5	51.0	Bone marrow stimulation	ACL perforation	36%	Significant higher anterior knee laxity Lysholm: 91.2, Tegner: 5.7	16
Evangelopoulos et al.[19]	Case control	Study: 23 Control: 33	39:17	30	24	Collagen membrane	DIS repair	0%	Study group vs control group Instrumented SSD: 1.0 mm vs 1.0 mm Lysholm: 100 vs 95 Tegner: 6 vs 5	19
Henle et al.[18,a]	Case series	69	42:27	32.4	≥24	Microfracturing	Sutures and DIS	2.9%	Instrumented SSD: 2.3 mm Lysholm: 97, Tegner: 5.1, IKDC: 94.8	10
Eggli et al.[15]	Case series	10	8:2	23.3	60.3	Microfracturing	Sutures and DIS	20%	Instrumented SSD: 2 mm Lysholm: 100, Tegner: 5.5, IKDC: 98.9	10
Murray et al.[20]	Cohort	Study: 10 Control: 10	6:14	24	3	BEAR scaffold	Suture	0%	Study group vs control group Lachman test: 8 grade A, 2 grade B vs 10 grade A IKDC: 54.3 vs 60.7	20

M, male; F, female; mo, months; yr, year; F/U, follow-up; d, day; mo, month NP, not provided; HRT, healing response technique; DIS, dynamic intraligamentary stabilization.
[a] There were 278 patients included in this study but only 69 patients were followed for a minimum of 2 years. The M:F, age at surgery, time from injury to surgery were obtained from the overall data.

Basic Science Update

Biologic Treatments for Sports Injuries II Think Tank—Current Concepts, Future Research, and Barriers to Advancement, Part 1

CME

Biologics Overview, Ligament Injury, Tendinopathy

Robert F. LaPrade,*‡ MD, PhD, Andrew G. Geeslin,§ MD, Iain R. Murray,‖ MD, PhD, Volker Musahl,¶ MD, Jason P. Zlotnicki,¶ MD, Frank Petrigliano,# MD, and Barton J. Mann,†** PhD
Investigation performed at Steadman Philippon Research Institute, Vail, Colorado, USA

ACL Repair With Biologic Augmentation: Preclinical Studies, Clinical Trial

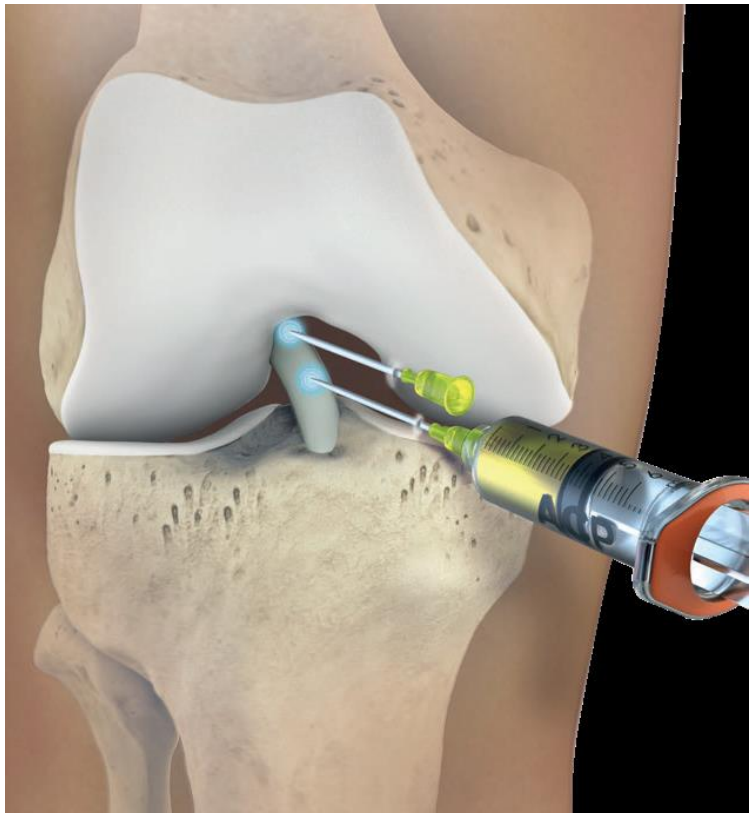
ACL bioenhanced repair and ACL reconstruction had no biomechanical differences in a porcine study.
The authors of a study of 64 minipigs with 4 groups (bioenhanced ACL repair, bioenhanced ACL reconstruction, traditional ACL reconstruction, and ACL transection) reported no difference in the biomechanical properties of an ACL repair versus reconstruction. Of note, there was a decreased incidence of chondral degeneration at 12 months for the bioenhanced ACL repair compared with both ACL transection and reconstruction.
Supported by preclinical studies, Murray et al recently initiated a prospective study of bioenhanced ACL repair in a select patient group (‘‘Bridge-Enhanced ACL Repair (BEAR) Clinical Trial’’; ongoing study).
LaPrade et al, *AJSM*, 2016.

MARKETTE ne var?

PRP/ACP/SANAKİN/PRGF/MSC/AUTOLOGIX

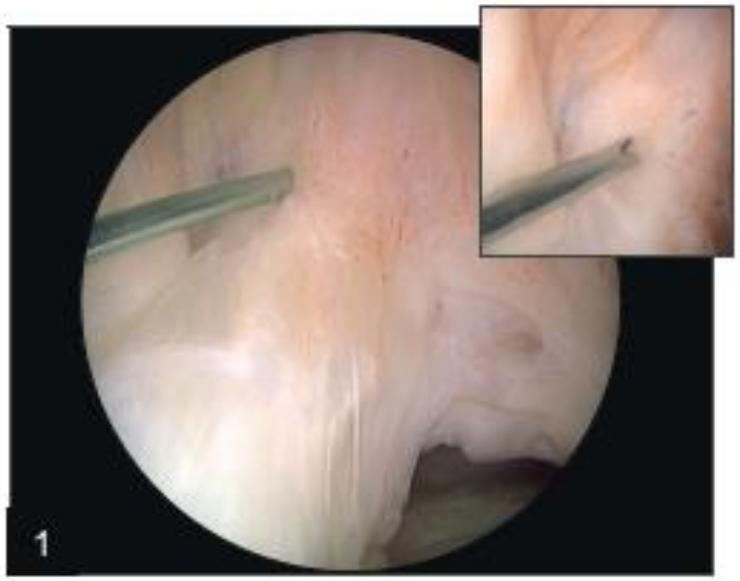
PRP/ACP

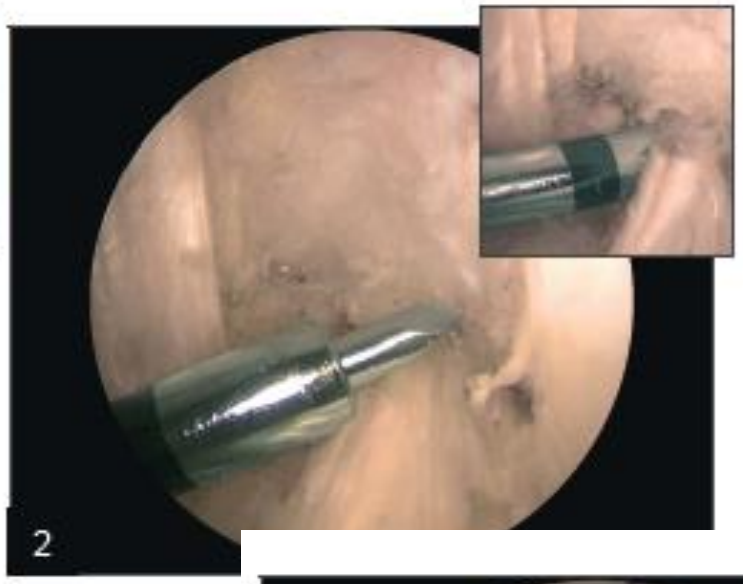
a. Lökositten zengin(PRP)
b. Lökositten fakir(ACP, Orthokine)

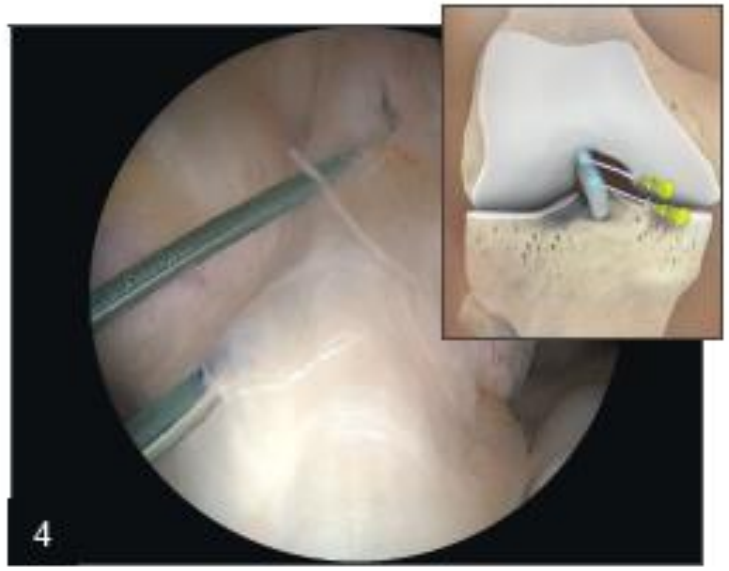


Genel sorun: Trombositten zengin plazmanın İA ortamda erimesi. Nedeni sinovial aktif Plasmin! Bu nedenle skafold gerekiyor.

Parsiyel ÖÇB yaralanması ACP tedavisi







Postop rehabilitasyon

0-2. HAFTA

20 derece fleksiyonda kilitli ortez

10 kg. kısmi yüklenme

Pasif ROM 0/20/60

3.-6. HAFTA

Fonksiyonel ortez 0/10/90

Gece 20 derece fleksiyonda kilitli dizlik devam

Tedrici tam yük verme

Propriyoseptif egzersizler

7. HAFTA VE SONRASI

Atletik eğitim

Klinik bakı(3.ay)

KT-1000(6.ay*)*

Köprü geliştirerek ÖÇB Tamiri

The Bridge-Enhanced Anterior Cruciate Ligament Repair (BEAR) Procedure

An Early Feasibility Cohort Study

Martha M. Murray,*† MD, Brett M. Flutie,† BA, Leslie A. Kalish,‡ ScD, Kirsten Ecklund,§ MD, Braden C. Fleming,‖ PhD, Benedikt L. Proffen,† MD, and Lyle J. Micheli,† MD

Investigation performed at Boston Children's Hospital, Boston, Massachusetts, USA

Murray M, *The Orthopaedic Journal of Sports Medicine,* 2016

BEAR Scaffold

The BEAR scaffold was manufactured at Boston Children's Hospital and completed all biocompatibility and sterility testing prior to use in the clinical study. The scaffold comprised extracellular matrix proteins, including collagen, that were obtained from bovine tissue. The DNA content of the scaffolds was less than 50 ng/mg of scaffold, and the scaffolds were not crosslinked. The scaffold measured 22 mm in diameter by 45 mm in length and was hydrophilic and able to absorb up to 5 times its weight in fluid. The BEAR scaffold softens when blood is added to it, making it conformable to the intra-articular notch and able to fill in the irregular contours of the gap between the torn ligament ends.

Am J Sports Med. 2013 August ; 41(8): 1762–1770. doi:10.1177/0363546513483446.

Use of a Bioactive Scaffold to Stimulate ACL Healing Also Minimizes Post-traumatic Osteoarthritis after Surgery

Martha M. Murray, M.D.[+] and **Braden C. Fleming, Ph.D.**[#,^]

[+]Department of Orthopaedic Surgery, Children's Hospital Boston, 300 Longwood Ave MA 02115

[#]Department of Orthopaedics, Warren Alpert Medical School of Brown University, Rh Hospital, Coro West, Suite 404, 1 Hoppin St, Providence RI 02903

[^]School of Engineering, Brown University, Providence, RI 02903

J Orthop Res. 2017 December ; 35(12): 2606–2612. doi:10.1002/jor.23632.

Bench-to-Bedside: Bridge-Enhanced Anterior Cruciate Ligament Repair

Gabriel S. Perrone, M.Sc.[+], **Benedikt L. Proffen, M.D.**[+], **Ata M. Kiapour, Ph.D.**[+], **Jakob T. Sieker, M.D.**[+], **Braden C. Fleming, Ph.D.**[~], and **Martha M. Murray, M.D.**[+]

[+]Department of Orthopaedic Surgery, Sports Medicine Research Laboratory, Children's Hospital Boston/Harvard Medical School, Boston, Massachusetts [~]Department of Orthopaedics, University/Rhode Island Hospital,

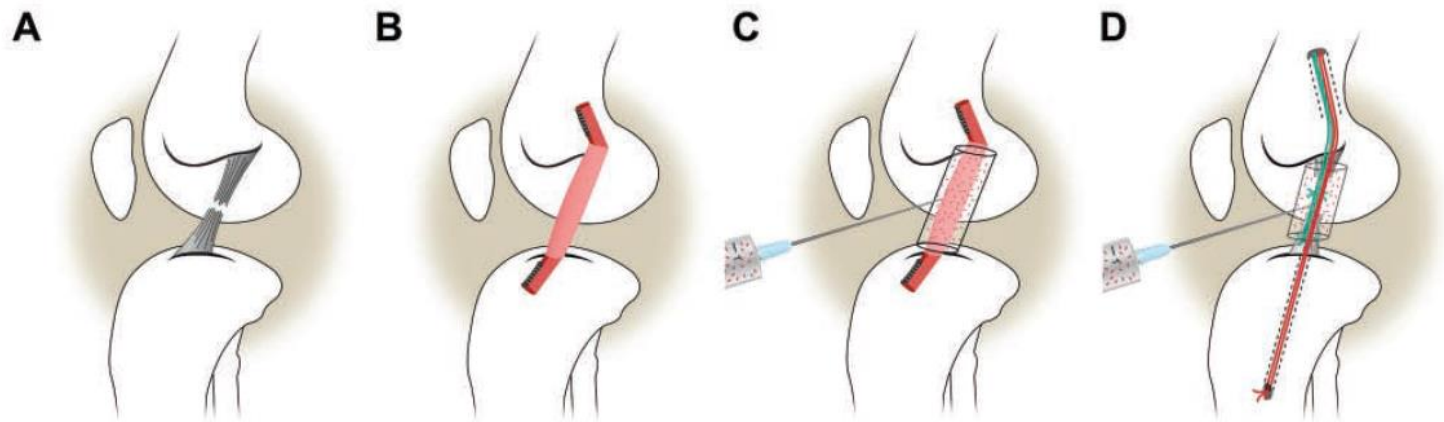
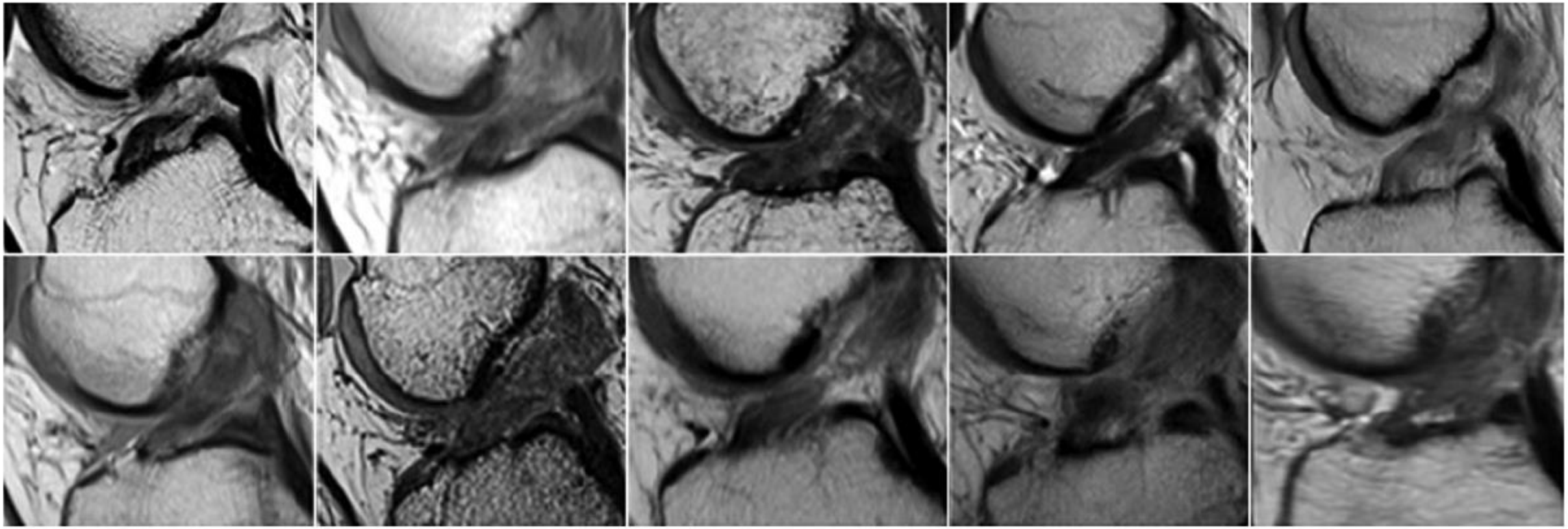


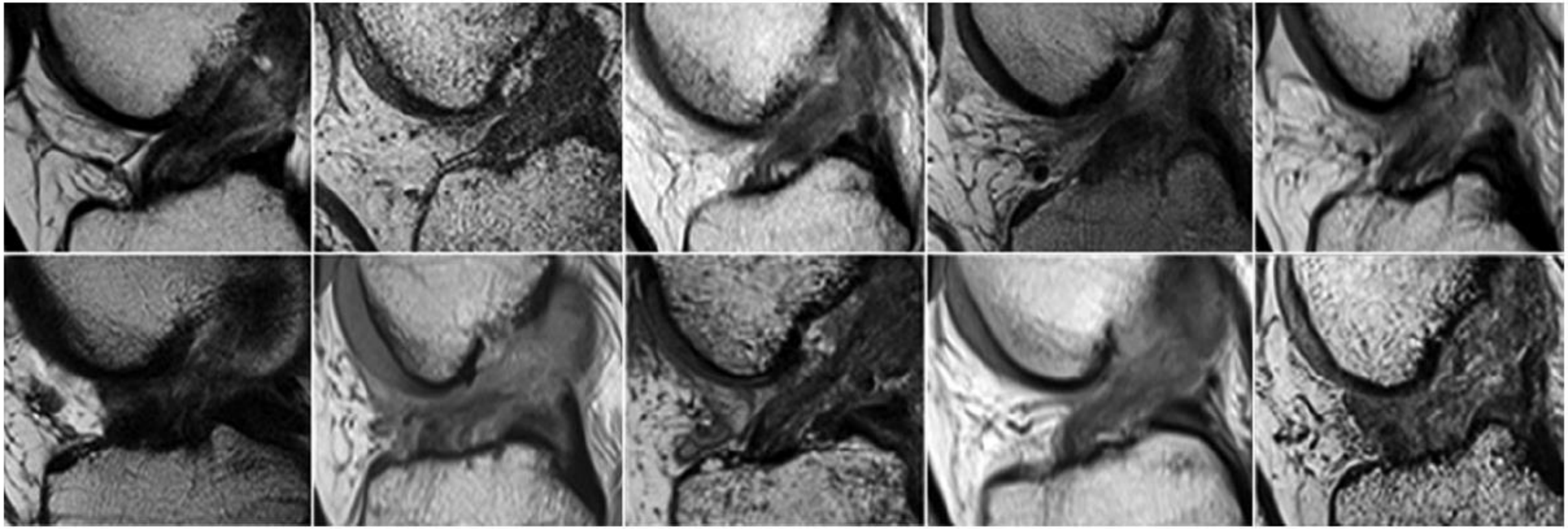
Figure 1. Four treatment groups were evaluated in this study: (A) ACL transection, (B) conventional ACL reconstruction, (C) bio-enhanced ACL reconstruction, and (D) bioenhanced ACL repair.

«Bear» planlanan10 olgunun PREOP MR görüntüleri



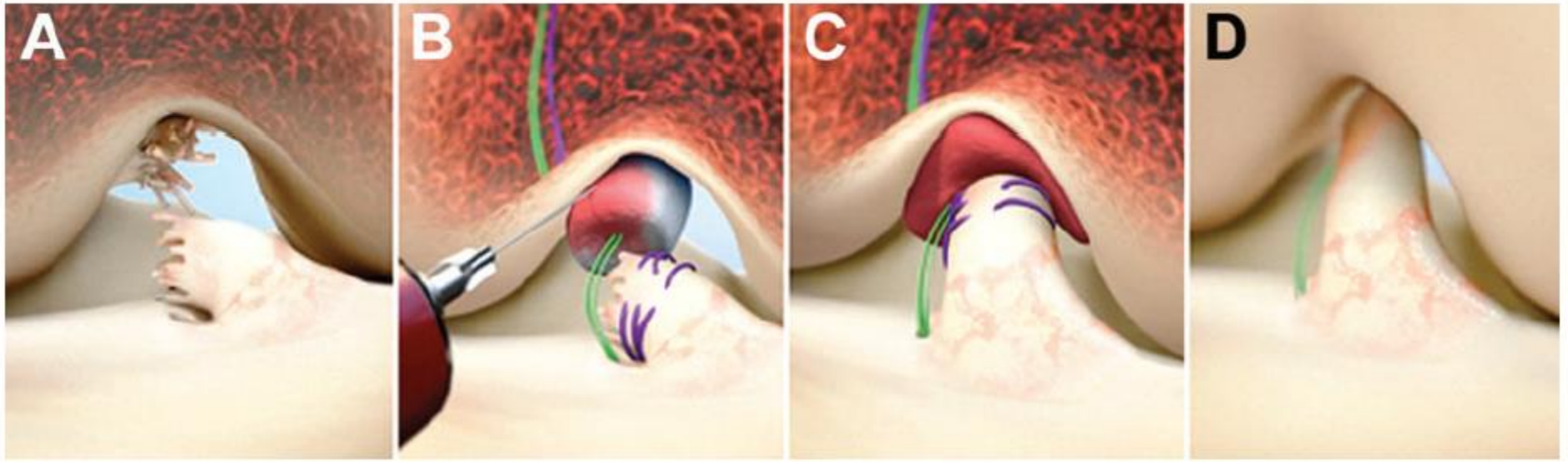
Murray M, *The Orthopaedic Journal of Sports Medicine,* 2016

ÖÇBR planlanan 10 olgunun PREOP MR görüntüleri

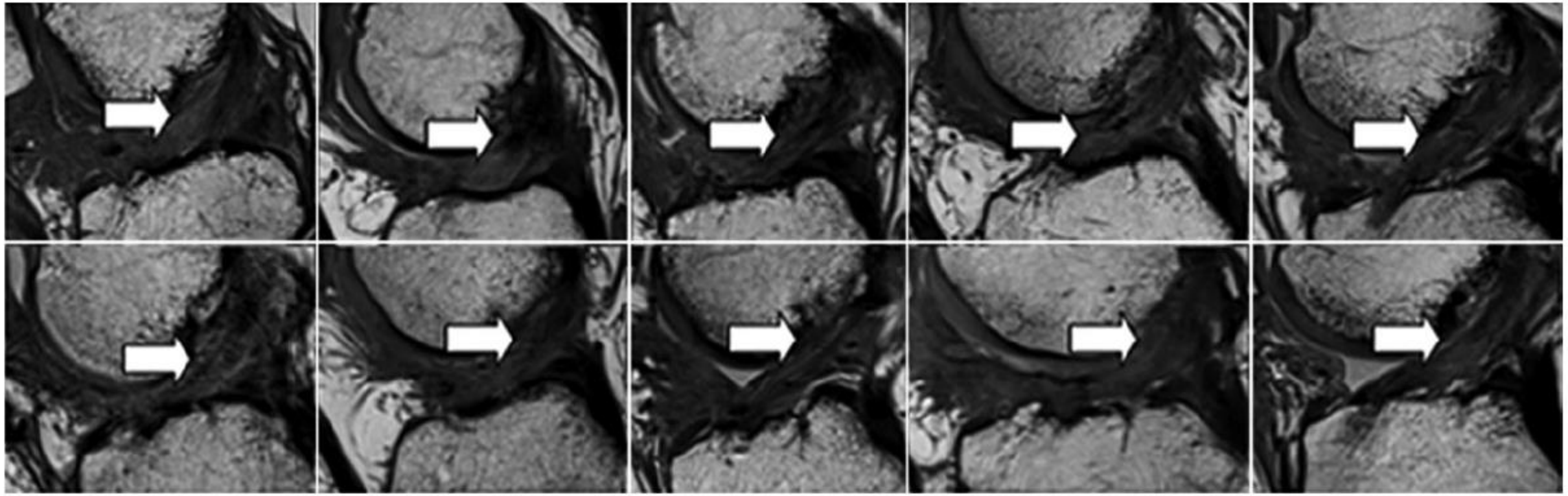


BEAR(Bridge-enhanced ACL repair)

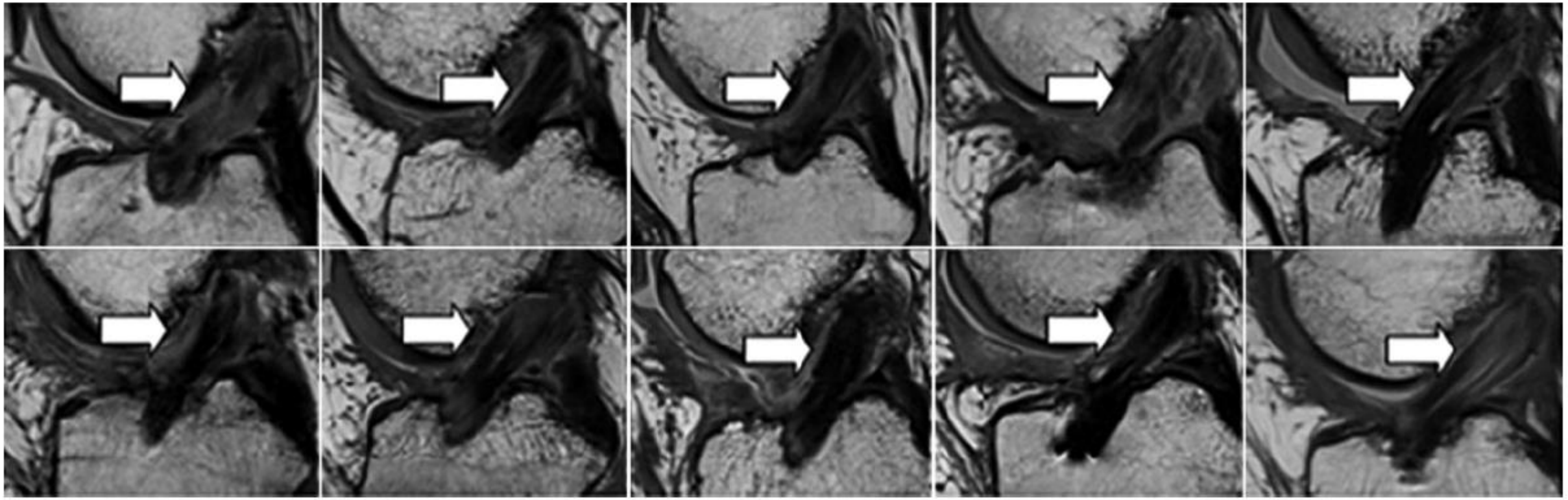
Murray et al, *OSJM*, 2016.



«B.E.A.R» uygulanan10 olgunun post-op 3. ay MR görüntüleri



ÖÇBR uygulanan10 olgunun postOP 3. ay MR görüntüleri



Outcomes Measured Only at 3 Months or Measured as Time Duration[a]

Outcome	Mean ± SD or n
Lachman laxity difference, mm[b]	
BEAR	1.10 ± 1.45
Grade A, n	8
Grade B, n	2
ACLR	0.60 ± 0.97
Grade A, n	10
Grade B, n	0
Hamstring strength, % contralateral[c]	
BEAR	77.9 ± 14.6
ACLR	55.9 ± 7.8
Hip abduction, % contralateral	
BEAR	95.4 ± 10.9
ACLR	96.8 ± 10.3
IKDC score (0-100)	
BEAR	54.3 ± 6.4
ACLR	60.7 ± 10.2
Return to school/work, wk	
BEAR	3.1 ± 3.3
ACLR	4.0 ± 4.2
Time using crutches, wk	
BEAR	4.7 ± 1.3
ACLR	4.8 ± 1.7
Thigh circumference 5 cm above patella, % contralateral	
BEAR	98.3 ± 1.7
ACLR	98.7 ± 2.5
Thigh circumference 10 cm above patella, % contralateral	
BEAR	94.1 ± 2.8
ACLR	95.4 ± 3.1

Knee Surg Sports Traumatol Arthrosc
DOI 10.1007/s00167-015-3838-7

KNEE

Collagen application reduces complication rates of mid-substance ACL tears treated with dynamic intraligamentary stabilization

Dimitrios S. Evangelopoulos[1] · Sandro Kohl[1] · Stefan Schwienbacher[1] · Benjamin Gantenbein[2] · Aristomenis Exadaktylos[3] · Sufian S. Ahmad[1,2]

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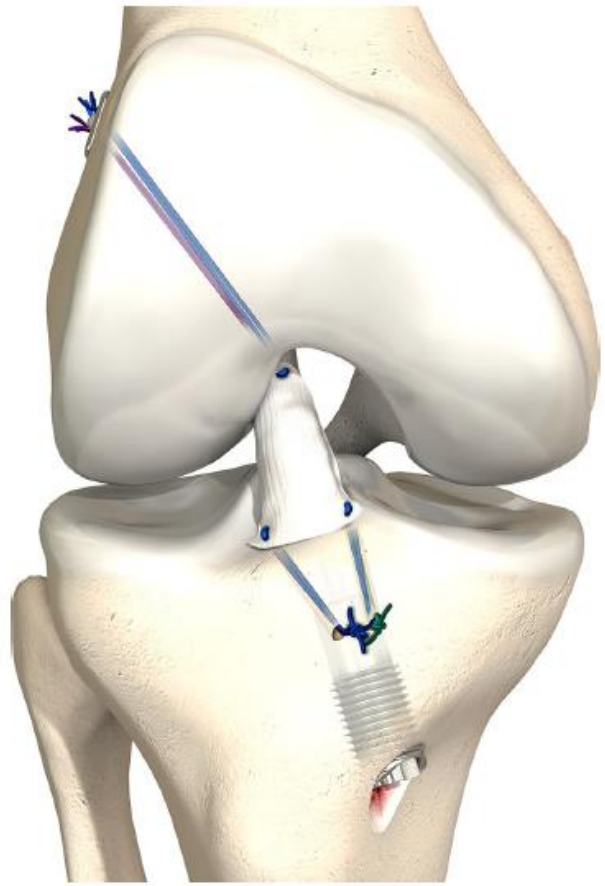
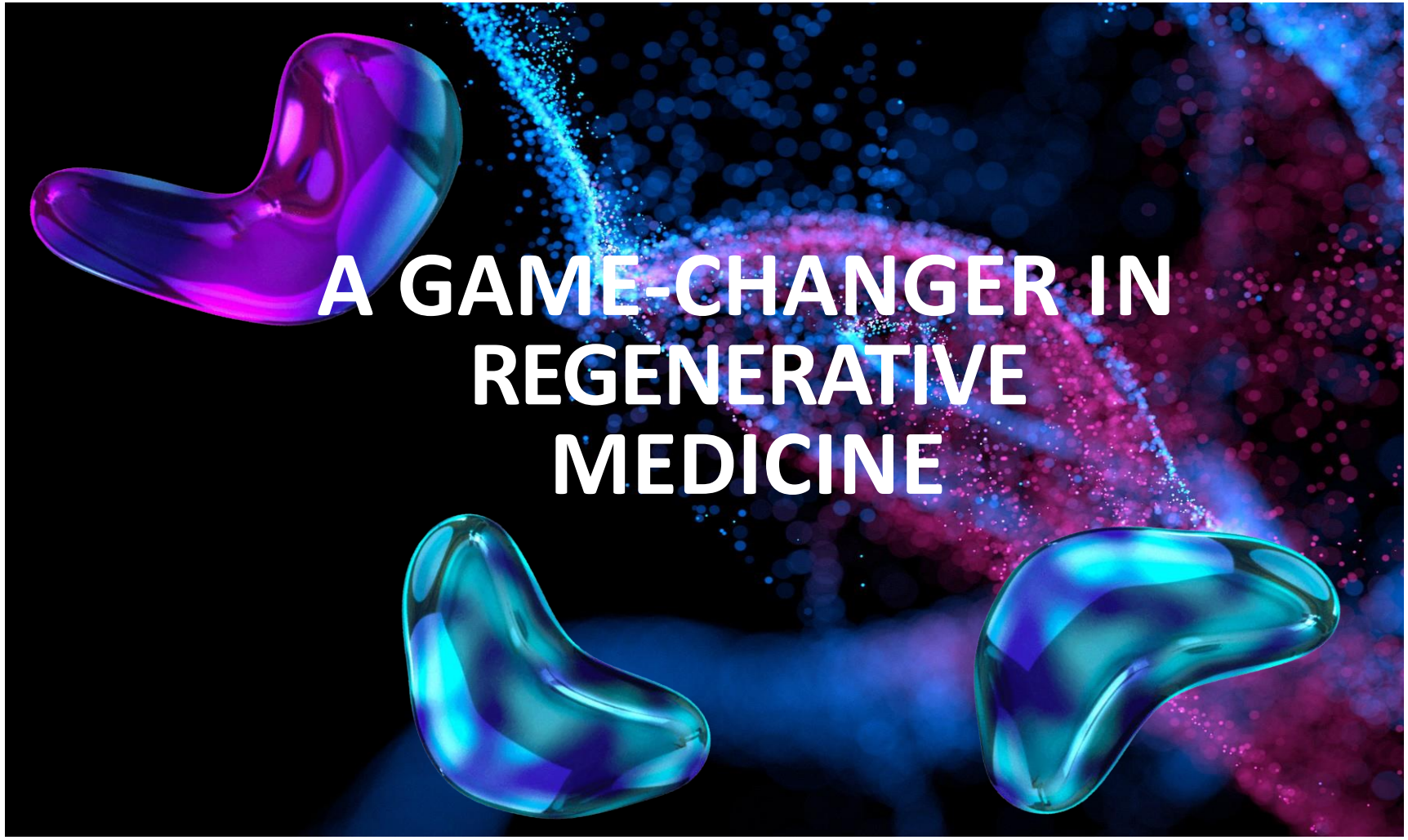
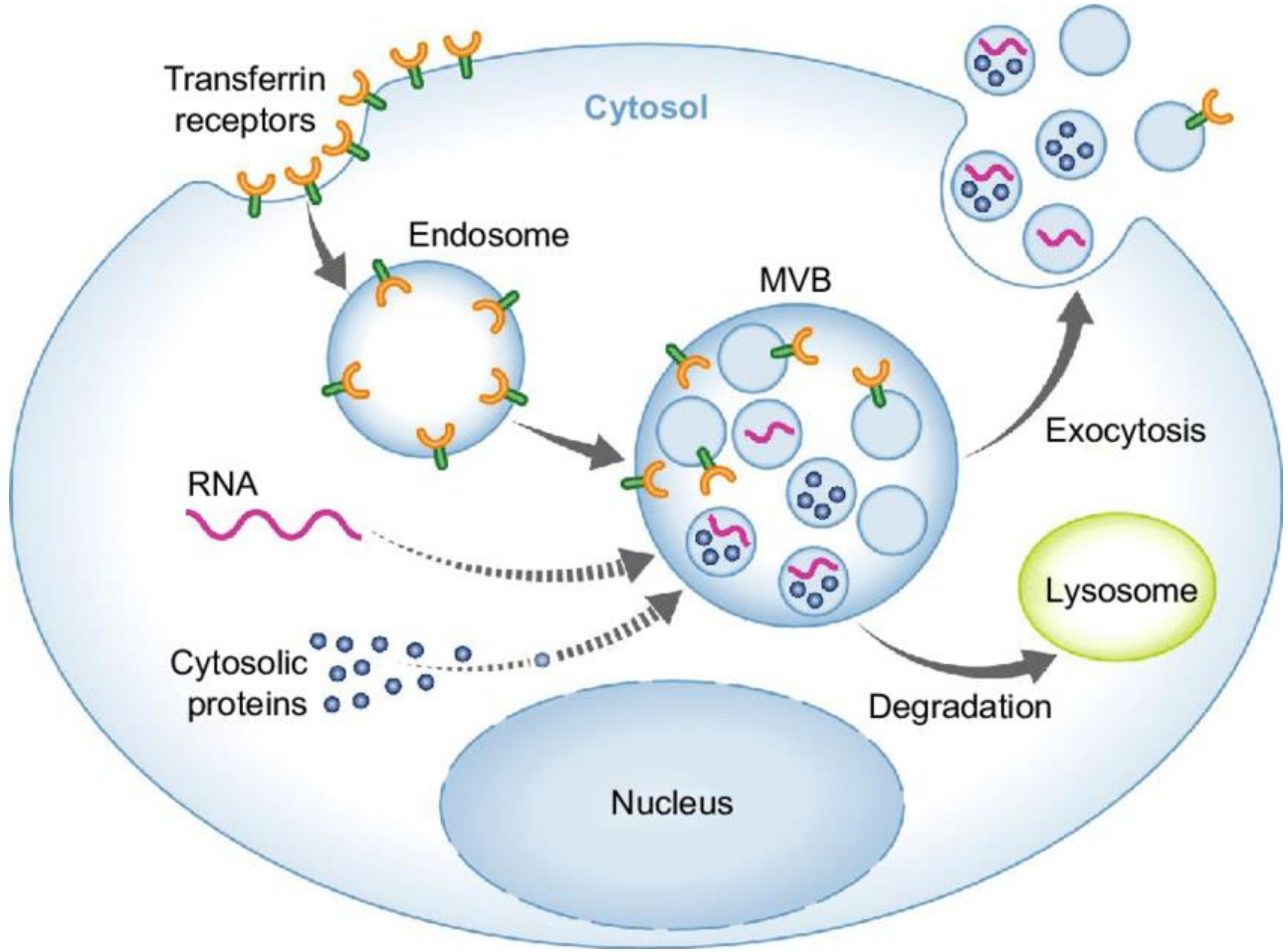


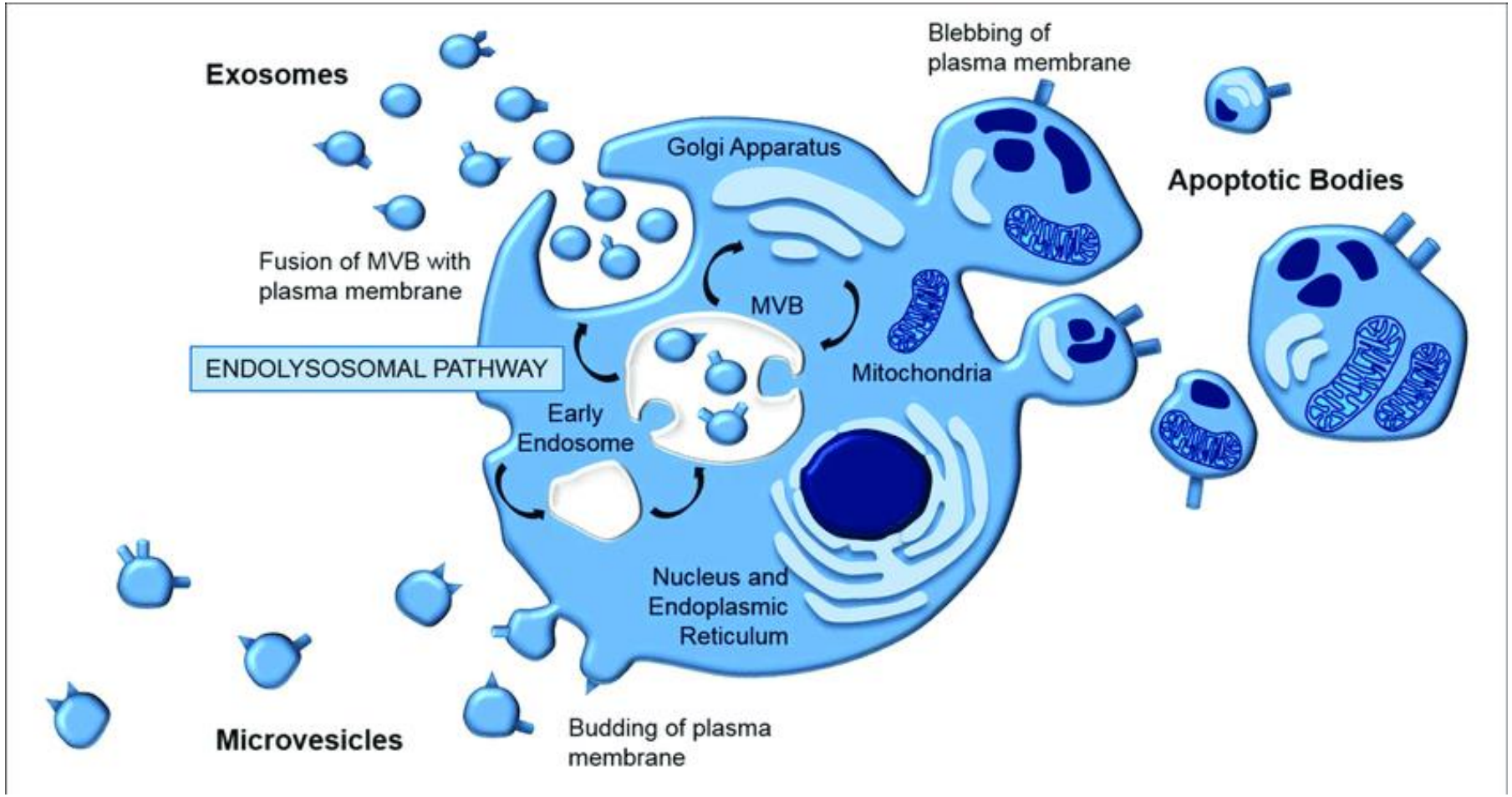
Exosome tedavisi

OTOLOG EKSOZOM
AUTOLOGIX

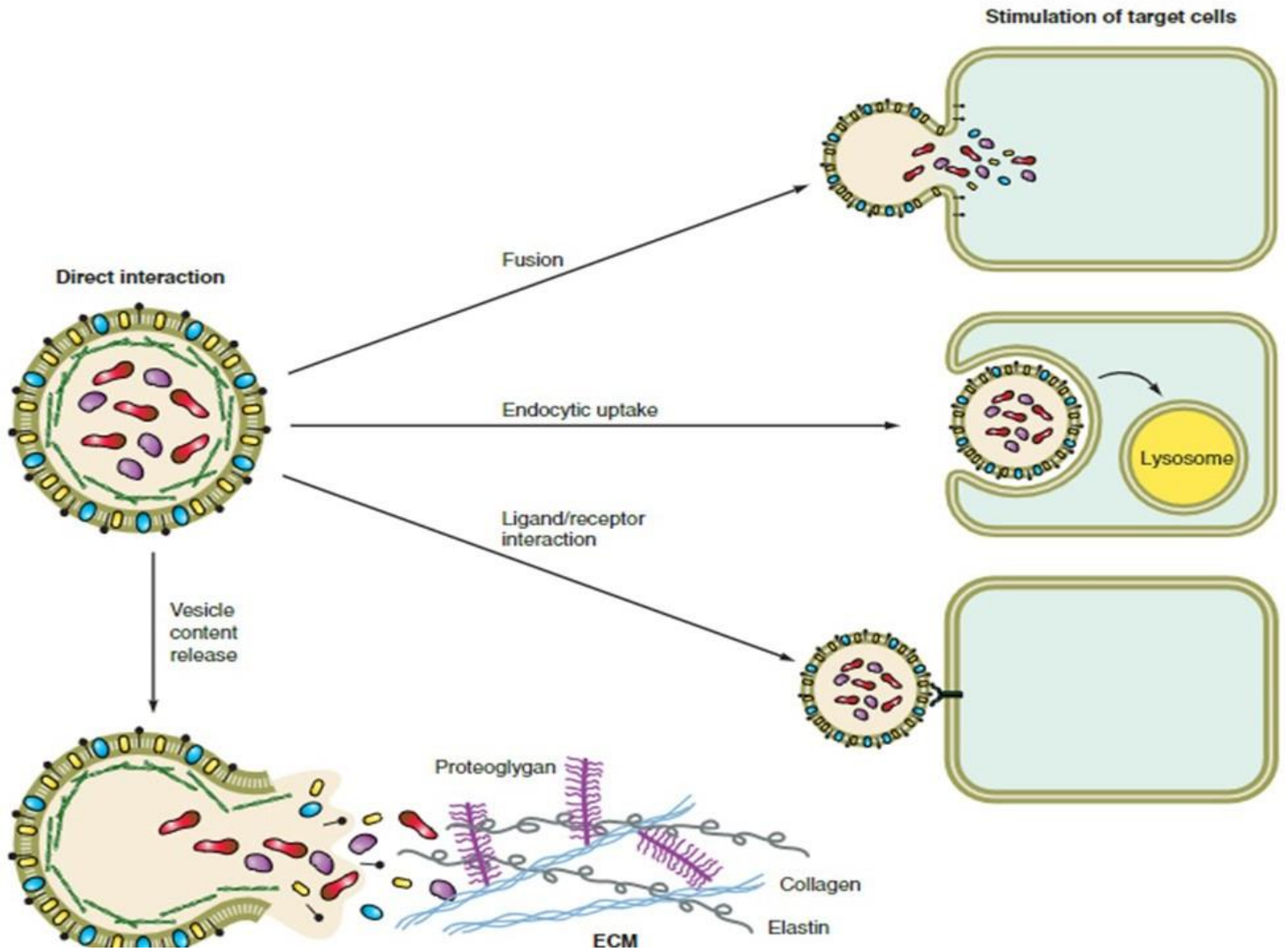
Your Body,
Your Cure:
The Future of Healthcare


A GAME-CHANGER IN
REGENERATIVE
MEDICINE


Transferrin
receptors
Cytosol
Endosome
MVB
Exocytosis
RNA
Lysosome
Cytosolic
proteins
Degradation
Nucleus


Exosomes
Blebbing of plasma membrane
Golgi Apparatus
Apoptotic Bodies
Fusion of MVB with plasma membrane
MVB
ENDOLYSOSOMAL PATHWAY
Mitochondria
Early Endosome
Nucleus and Endoplasmic Reticulum
Microvesicles
Budding of plasma membrane

HEDEF HÜCRE İLE EKSOZOM ETKİLEŞİMİ



Osteointegration of a Novel Silk Fiber–Based ACL Scaffold by Formation of a Ligament-Bone Interface

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1–8
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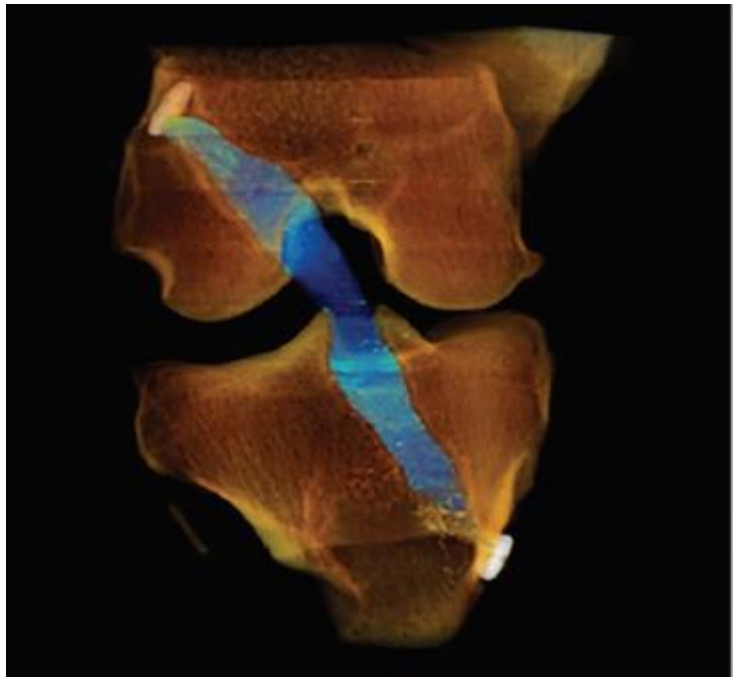

In summary, the novel silk fiber–based scaffold for ACL regeneration demonstrated integration into the bone tunnels via the formation of a fibrous interzone similar to allografts and autografts. Additional cell seeding did not enhance osteointegration. After 12 months, there was still a considerable amount of silk present, and a longer observation period is necessary to see if a true ligament-to-bone enthesis will be formed.

Gelecek

PRİMER SÜTÜR+PRP/ACP+Skafold?/Exosome?

İntraligamentöz atelleme (Device? Fibertape)?/Kollajen membran KÖPRÜLEME?

Gen tedavisi?

Cerrahi sonrası mukopoligen komplex=glikozaminoglikan+tip I kollajen+vit C *retendo®* destek tedavisi? *(Torrent et al, OA&Cartılage 2009)*

Primer sütür+PRP+simvastatin? (*Zhang et al., AJSM 2019)*

Retendo:
↓ IL-1β
↓ Pro-inflamatuar sitokin üretimi
↓ NF-kB
↓ COX-2, Kaspaz-3, MMP-1
↓ TNF-α
↓ Apoptosis i inhibe eder!

Özet

1. Komplet/İnkomplet AKUT ÖÇB YARALANMALARInın spontan İYİLEŞMESİ, instabilite ve o/a yaratmadan neredeyse olanaksızdır Dallo, *OJSM,* 2017.
2. İntraligamantöz atelleme hariç, AKUT primer TAMİR tek başına yeterli stabilite sağlayamaz.
3. Akut tamir ve biyolojik augmentasyonun sonuçları, tek başına primer tamirden üstündür.
4. Biyolojik tedavi kararında ÖÇB yaralanmasının lokalizasyonu, eşlik eden diğer yaralanmaların varlığı doğru endikasyon için çok önemli!
5. *ÖÇB-R HALA altın standarttır*!

TEŞEKKÜRLER