

# Maximising Bone Marrow Extraction

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No Disclosures

# Maximising Bone Marrow Extraction

Why?

How?

WHY

0.01 to 0.001%

WHY

**ALL** studies are showing its Dose-Related

What do Clinical Trials say about dosing?



TRANSLATIONAL AND CLINICAL  
RESEARCH

**Percutaneous Injection of Autologous Bone  
Marrow Concentrate Cells Significantly Reduces  
Lumbar Discogenic Pain Through 12 Months**

KENNETH A. PETTINE,<sup>a</sup> MATTHEW B. MURPHY,<sup>b,c</sup> RICHARD K. SUZUKI,<sup>c</sup> THEODORE T. SAND<sup>c</sup>

# Pettine

CFU-f	ODI	ODI 1YR
<2000	54	26
>2000	59	18

CFU-f	VAS	VAS 1YR
<2000	80	35
>2000	82	26



## Greater than 2,000 CFU-F/ml,

Regardless of age **ALL** patients who received >2,000 CFU-F/ml reported >40% reduction in ODI and VAS scores at 3 and 6 months.

Regardless of age, demonstrated an average improvement of **0.58** in modified Pfirrmann Score



# A dose response analysis of a specific bone marrow concentrate treatment protocol for knee osteoarthritis

Christopher J. Centeno<sup>1</sup>, Hasan Al-Sayegh<sup>1\*</sup>, Jamil Bashir<sup>1</sup>, Shaun Goodyear<sup>2</sup> and Michael D. Freeman<sup>3</sup>

373 Patients

12 months

# Centeno Knee OA

TNC	DECREASE IN VAS
<400	1.6
>400	3.2

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ORIGINAL PAPER

# **Biologic augmentation of rotator cuff repair with mesenchymal stem cells during arthroscopy improves healing and prevents further tears: a case-controlled study**

**Philippe Hernigou • Charles Henri Flouzat Lachaniette •  
Jerome Delambre • Sebastien Zilber • Pascal Duffiet •  
Nathalie Chevallier • Helene Rouard**

# HERNIGOU SHOULDER

100 % of patients with MSC augmentation had healed by six months, versus only 67 % without MSC treatment by six months.

6 failures at 10y f/u compared to 25 failures in control group

54000 MSCs vs 14000 MSCs

➤ [Clin Orthop Relat Res.](#) 2002 Dec;(405):14-23. doi: 10.1097/00003086-200212000-00003.

# Treatment of osteonecrosis with autologous bone marrow grafting

[Philippe Hernigou](#) <sup>1</sup>, [Françoise Beaujean](#)

Affiliations + expand

PMID: 12461352 DOI: [10.1097/00003086-200212000-00003](#)

## **HERNIGOU HIP**

189 HIPS

5-10 Yr F/U

Only 34 (18%) needed THR

# Hernigou HIP

**TABLE 4. Number (thousands) of Colony-Forming Units Estimated to be Transplanted in the Femoral Head and Outcome of the Hip.**

Etiologic Factors	Number of hips in each stage				Number of Hips (and Mean of Colony-Forming Units Injected)	
	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>Arthroplasty</i>	<i>Without Arthroplasty</i>
Steroids	6	14 (2)	3 (1)	8 (8)	11 hips (0.6 CFU-F)	20 hips (5.4 CFU-F)
Alcohol	21	19	4 (2)	12 (6)	8 hips (1.1 CFU-F)	48 hips (6.1 CFU-F)
Sickle cell disease	24	32	2	6 (2)	2 hips (7.3 CFU-F)	62 hips (105.6 CFU-F)
Organ transplantation	3 (2)	12 (5)	2 (2)	4 (3)	12 hips (0.4 CFU-F)	9 hips (3.6 CFU-F)
Idiopathic	3	4	1	2 (1)	1 hip (4.3 CFU-F)	9 hips (17.0 CFU-F)
Others	2	5			0 hips	7 hips (16.7 CFU-F)





# **Subchondral stem cell therapy versus contralateral total knee arthroplasty for osteoarthritis following secondary osteonecrosis of the knee**

**Philippe Hernigou<sup>1</sup> • Jean Charles Auregan<sup>1</sup> • Arnaud Dubory<sup>1</sup> • Charles Henri Flouzat-Lachaniette<sup>1</sup> • Nathalie Chevallier<sup>1</sup> • Helene Rouard<sup>1</sup>**

# Hernigou SubChondral study for knees

Patients followed for 12 years

Pain relief similar in both groups

Patients with <1200 MSCs/ml had poor Cartilage and BML healing

> [J Bone Joint Surg Am.](#) 2006 Sep;88 Suppl 1 Pt 2:322-7. doi: 10.2106/JBJS.F.00203.

# **Percutaneous autologous bone-marrow grafting for nonunions. Surgical technique**

[Ph Hernigou](#) <sup>1</sup>, [G Mathieu](#), [A Poignard](#), [O Manicom](#), [F Beaujean](#), [H Rouard](#)

Affiliations + expand

PMID: 16951103 DOI: [10.2106/JBJS.F.00203](#)

55000 MSCs (53 patients) **vs** 17000 (7 patients)

**How to maximise Bone Marrow Extraction?**

# Maximising Bone Marrow Extraction

Posterior Iliac crest

BILATERAL Aspiration

10 cc Syringes

6 Bone punctures

18 Aspiration sites

Rapid pull

3-4 ml Aspirate volume

15g needle with a drill

**Prospective Study**

# **Evaluation of the Effectiveness of Autologous Bone Marrow Mesenchymal Stem Cells in the Treatment of Chronic Low Back Pain Due to Severe Lumbar Spinal Degeneration: A 12-Month, Open-Label, Prospective Controlled Trial**

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Sairam Atluri, MD<sup>1</sup>, Matthew B. Murphy, PhD<sup>2</sup>, Ryan Dragella, PhD<sup>3</sup>, Jessica Herrera, BS<sup>3</sup>, Kwadwo Boachie-Adjei, BS, CPH<sup>4</sup>, Sachi Bhati<sup>1</sup>, Vivek Manocha, MD<sup>5</sup>, Navneet Boddu, MD<sup>6</sup>, Pavan Yerramsetty, MD<sup>7</sup>, Zaid Syed<sup>1</sup>, Meghana Ganjam<sup>1</sup>, Divit Jain<sup>1</sup>, Zaynab Syed<sup>1</sup>, Nikhil Grandhi<sup>8</sup>, and Laxmaiah Manchikanti, MD<sup>9</sup>

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Author	CFU-f
Atluri	44883
Pettine	18991
Hernigou	29000

Author	TNC (millions)
Atluri	2104
Hernigou	900 (300ml)
Centeno	400
Pettine	847

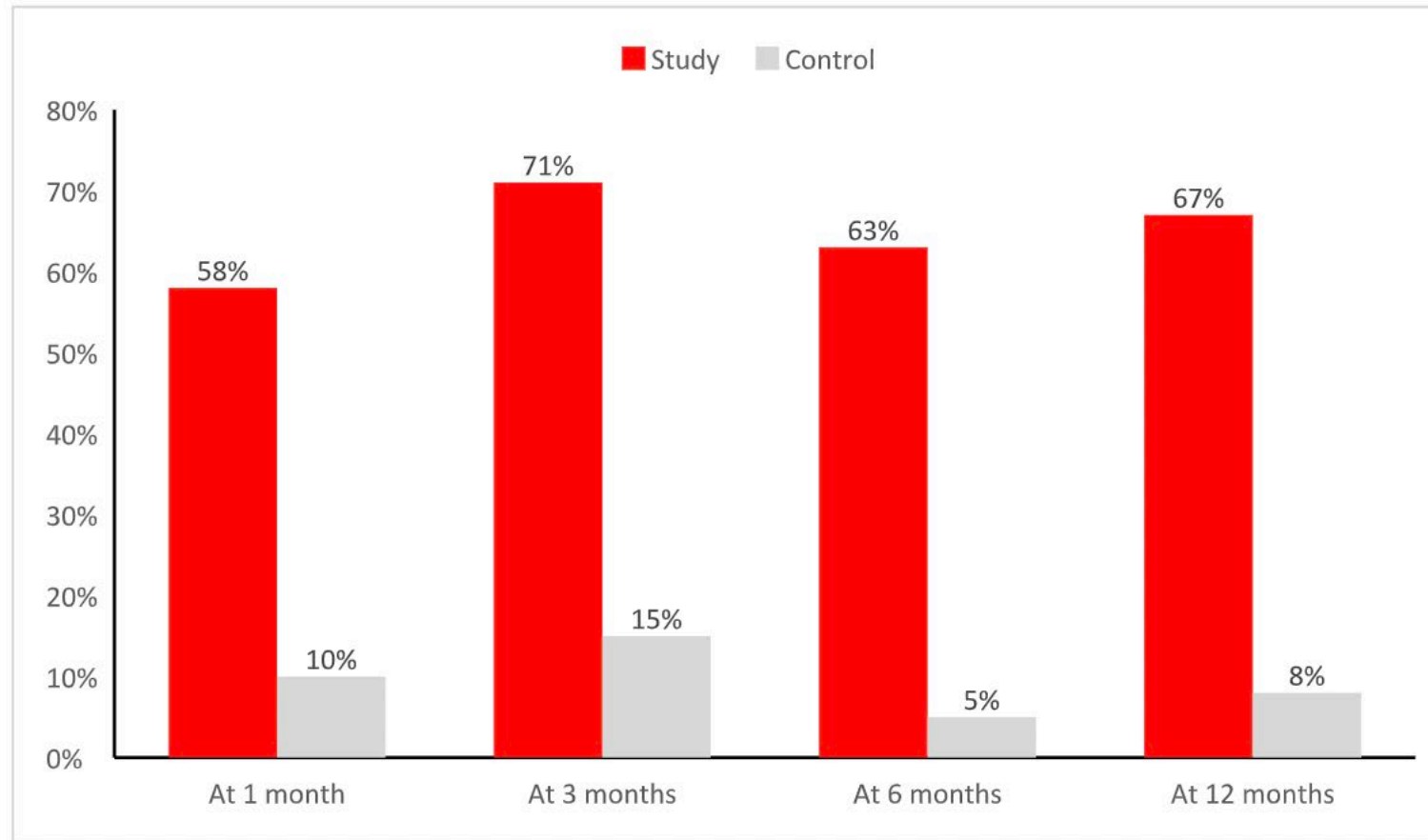


Figure : Percentage of patients who achieved the MCID (10 points decrease) for ODI

20-30 Minutes

# WHY

Better Outcomes

Advancing the field

Patient referrals

Injecting multiple structures

Establish working “dose” ranges

Thank you