

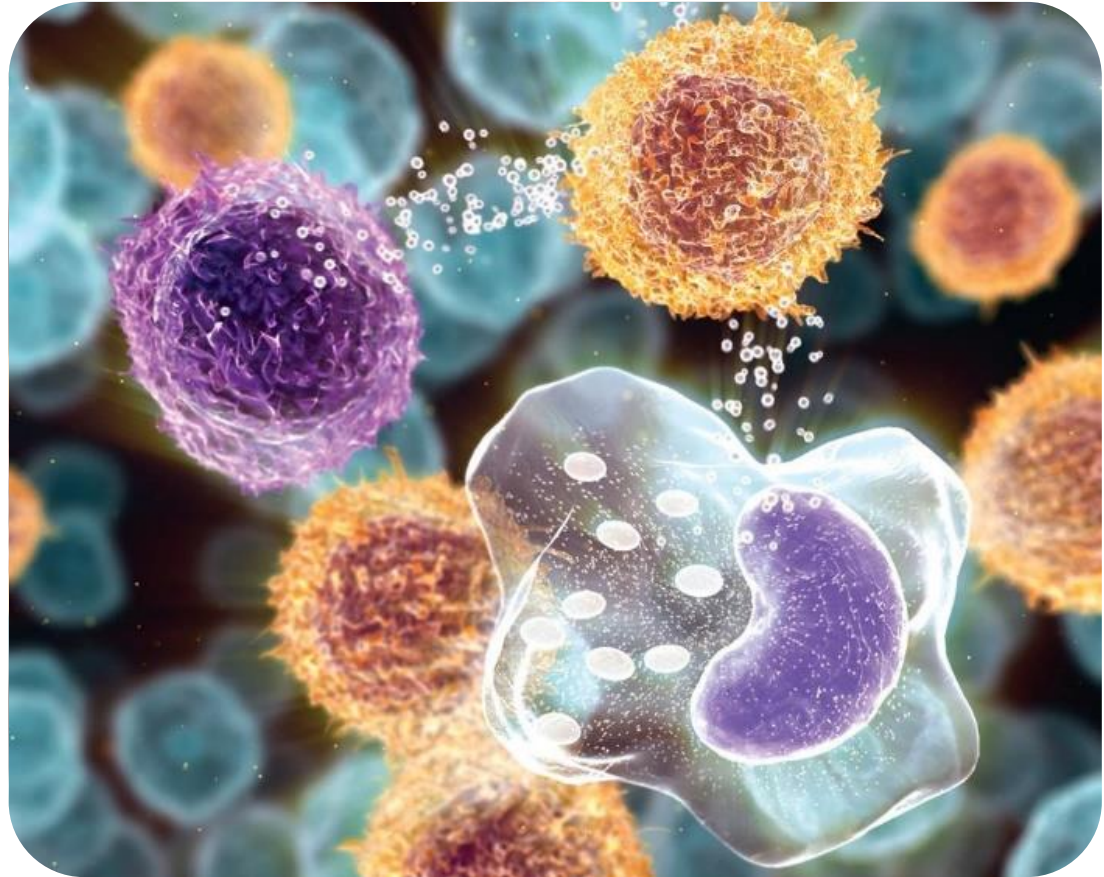
**Protokin**

*Future is here*

**SK. Shakouri MD  
Professor of PM&R**

# Molecular Medicine

- The molecular medicine perspective emphasizes cellular and molecular phenomena and interventions rather than the previous conceptual and observational focus on patients and their organs.



# Platelet-Rich-Plasma

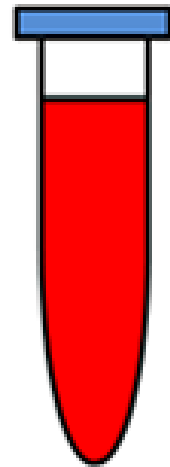


# PRP preparation

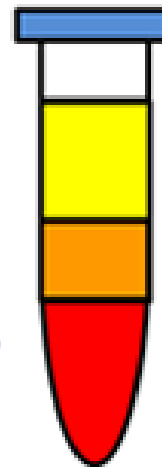
- Leukocyte
- Count

## Preparation of platelet-rich plasma (PRP)

human blood sample  
(with anticoagulant)

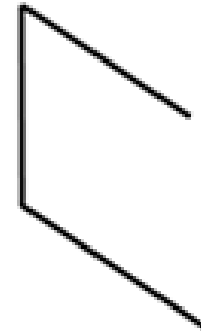


1<sup>st</sup>  
centrifugation  
(light spin)

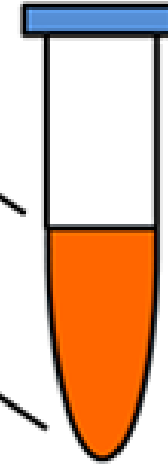


PLT &  
WBC  
BC  
RBC

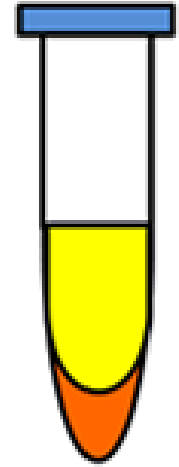
PLT = platelets  
WBC = white blood cells  
BC = buffy coat  
RBC = red blood cells



transfer across  
PLT, WBC & BC



2<sup>nd</sup>  
centrifugation  
(medium spin)



PPP  
PRP

PPP = platelet-poor plasma  
PRP = platelet-rich plasma

# PRP in OA !

## Platelet-rich plasma in osteoarthritis treatment: review of current evidence

Lucía Gato-Calvo, Joana Magalhaes, Cristina Ruiz-Romero, Francisco J. Blanco and Elena F. Burguera 

**Abstract:** Platelet-rich plasma (PRP) is defined as a volume of plasma with a platelet concentration higher than the average in peripheral blood. Many basic, preclinical and even clinical case studies and trials report PRP's ability to improve musculoskeletal conditions including osteoarthritis, but paradoxically, just as many conclude it has no effect. The purpose of this narrative review is to discuss the available relevant evidence that supports the clinical use of PRP in osteoarthritis, highlighting those variables we perceive as critical. Here, recent systematic reviews and meta-analyses were used to identify the latest randomized controlled trials (RCTs) testing a PRP product as an intra-articular treatment for knee osteoarthritis, compared with an intra-articular control (mostly hyaluronic acid). Conclusions in the identified RCTs are examined and compared. In total, five recent meta-analyses and systematic reviews were found meeting the above criteria. A total of 19 individual trials were identified in the five reviews but only 9 were level of evidence I RCTs, and many had moderate or high risks of bias. At present, results from these RCTs seem to favor PRP use over other intra-articular treatments to improve pain scales in the short and medium term (6–12 months), but the overall level of evidence is low. As a result, clinical effectiveness of PRP for knee osteoarthritis treatment is still under debate. This is, prominently, the result of a lack of standardization of PRP products, scarceness of high quality RCTs not showing high risks of bias, and poor patient stratification for inclusion in the RCTs.

## Platelet-rich plasma treatment in football injuries

By Andrea Ferretti, professor and chairman of the Department of Orthopaedic Surgery and Kirk Kilgour Sports Injury Centre, Sant'Andrea University Hospital, Rome, Italy



### Conclusions

PRP is an exciting new technology which may have the potential to serve as an alternative or adjuvant treatment to surgery for many common football injuries, the safety of which has been confirmed by several studies. Although justified by a strong biologic rationale, more evidence is needed to validate its use in a clinical setting and to support its widespread use. The majority of human studies have

### con Anti-doping regulations and PRP

Platelet-derived preparations administered by intramuscular, intratendinous or intraarticular routes have been removed from the WADA Prohibited List for 2011, which now applies in all UEFA competitions. They therefore no longer require a therapeutic use exemption (TUE). Current studies on PRP do not demonstrate any potential for performance controlled double-blind studies that meet the requirements for properly powered studies. Moreover, while great business has been generated by this new technology, any potential economic benefit for institutions and practitioners should be considered within a more comprehensive evaluation of the technique. However, although preparation methods, injection procedures and rehabilitation protocols should be standardised, the use of PRP in the treatment of football-related injuries appears to be a promising advance worthy of further investigation. ●

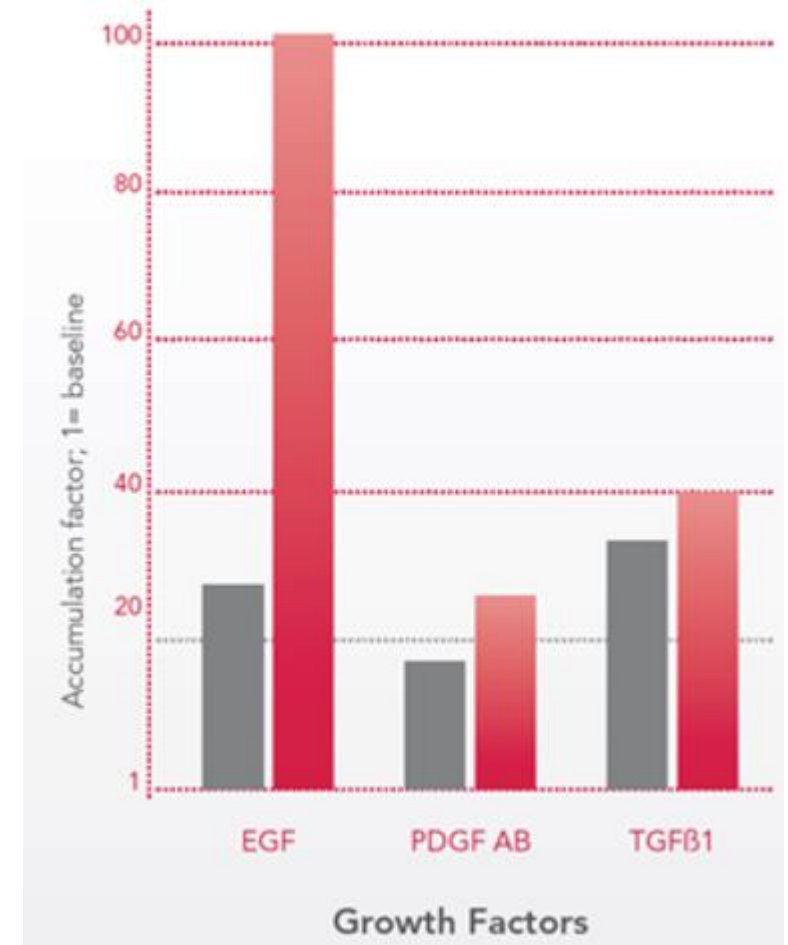
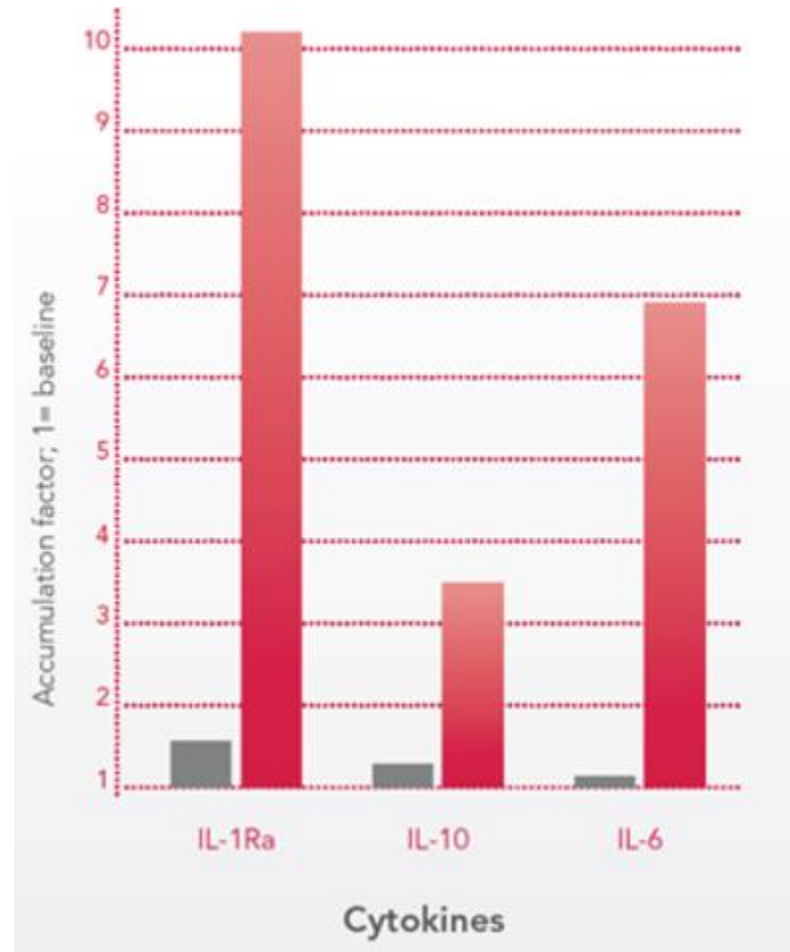
# Autologous Conditioned Serum



# Growth Factors Delivery Methods

**Old Version:  
Platelet-Rich  
Plasma (PRP)**

**New Version:  
Autologous  
Conditioned  
Serum (ACS)**



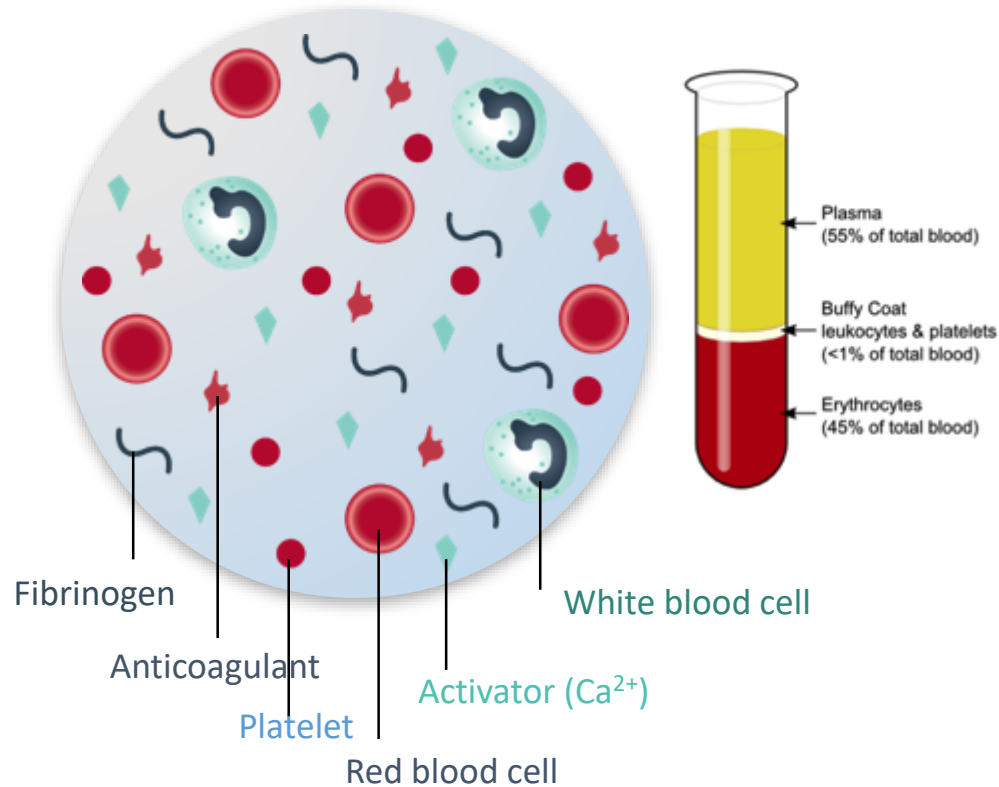


# Orthokine<sup>®</sup> Serum vs PRP or ACP



Plasma contains cells, clotting factors and additives

Serum is cell-free and clotting factor free, and contains **no** additives

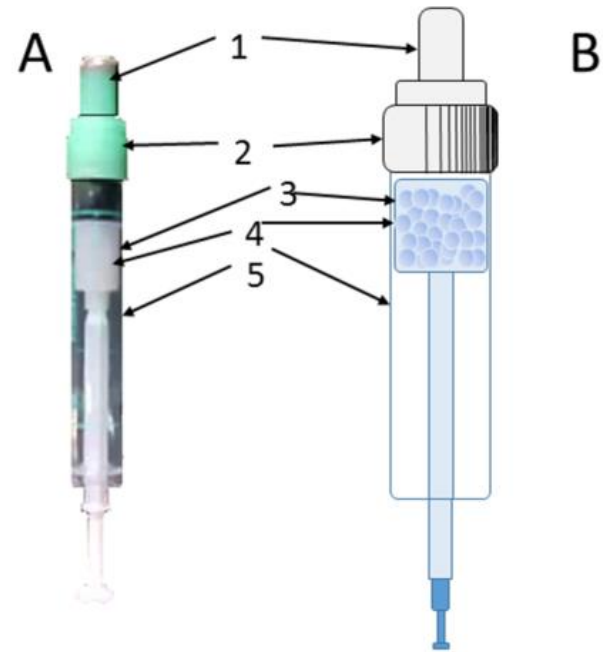


No platelets –  
No white blood cells –  
No red blood cells –  
No additives –

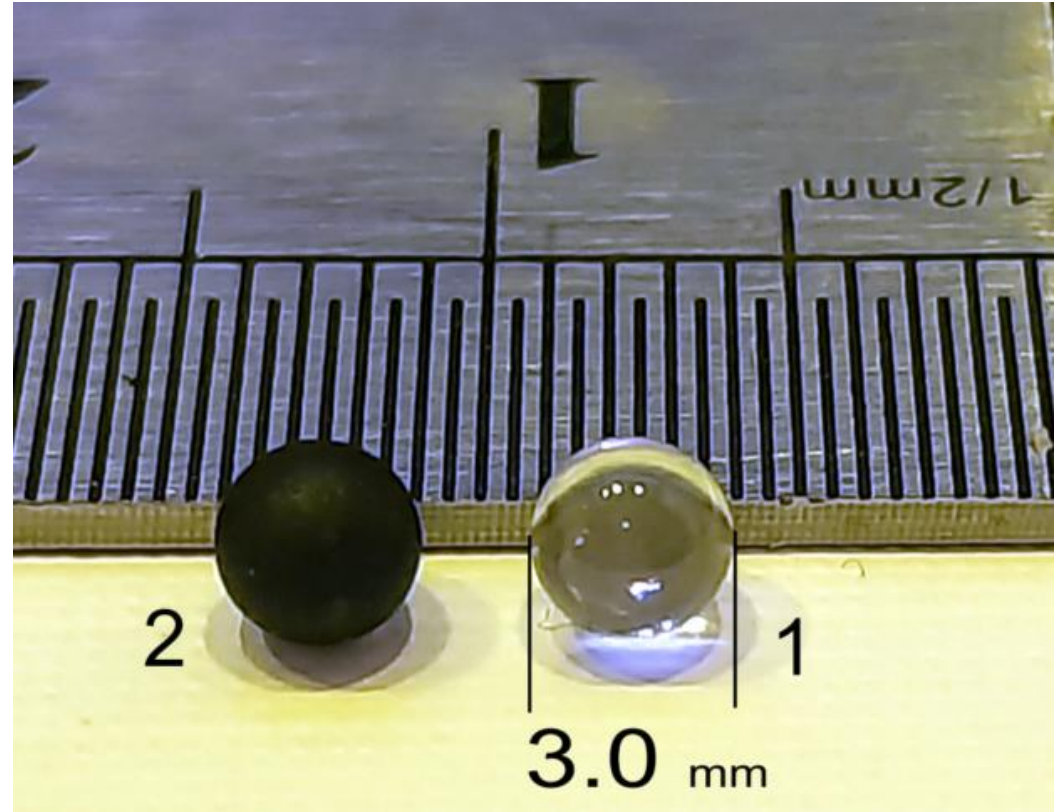
All these cells and coagulation factors in PRP/ACP can be cell/joint damaging

# Heila ART

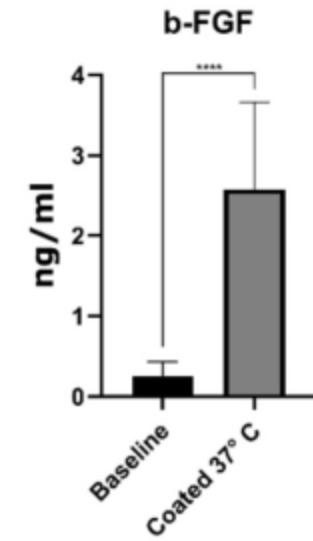
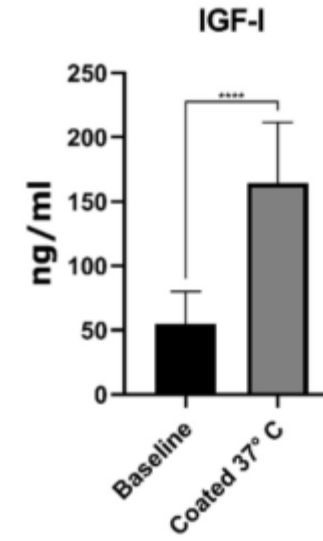
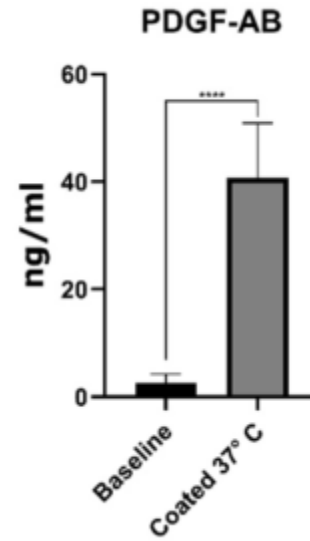
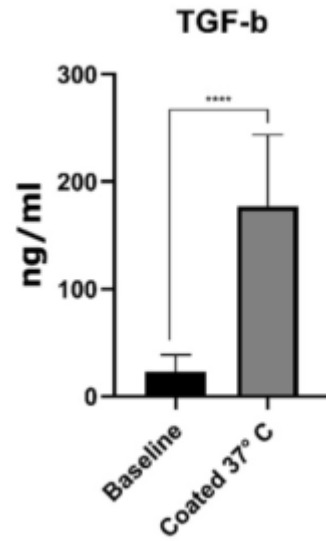
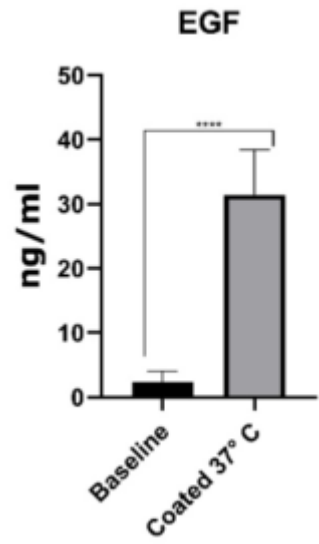
We Grow Your Potentials



# Black Pearl Technology



# Growth Factors in **Heila**

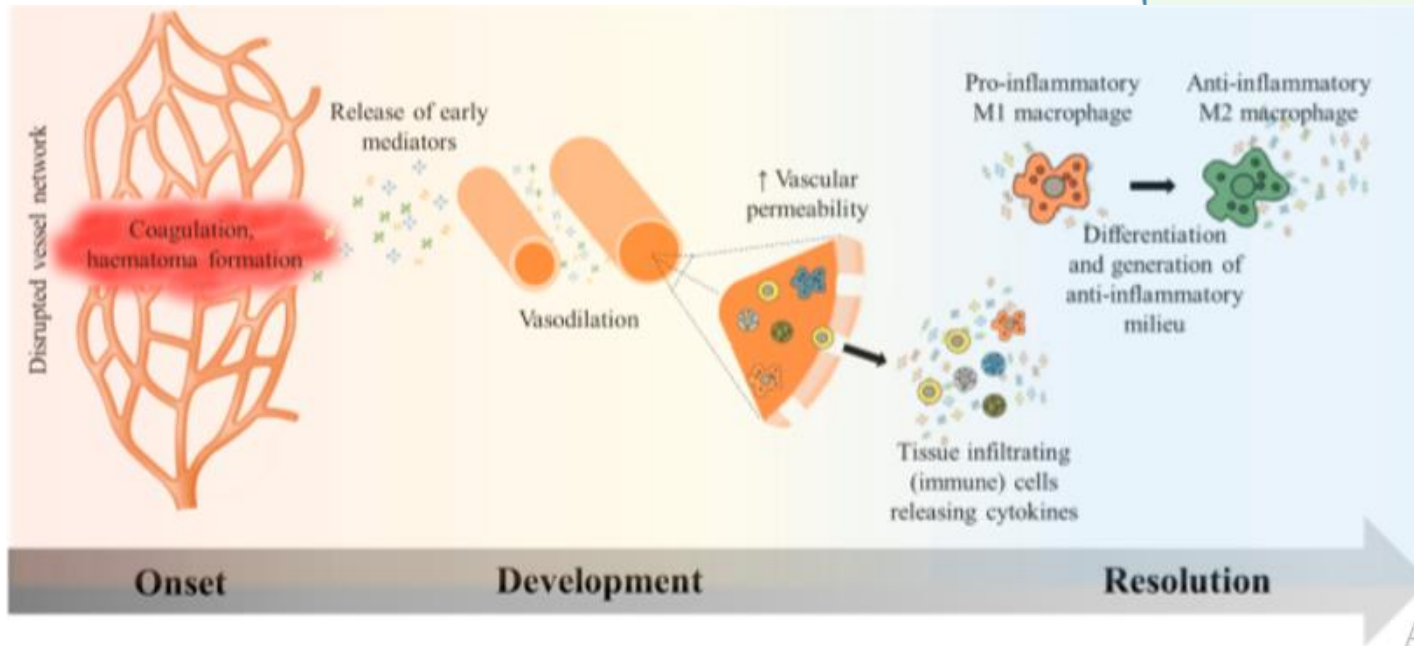
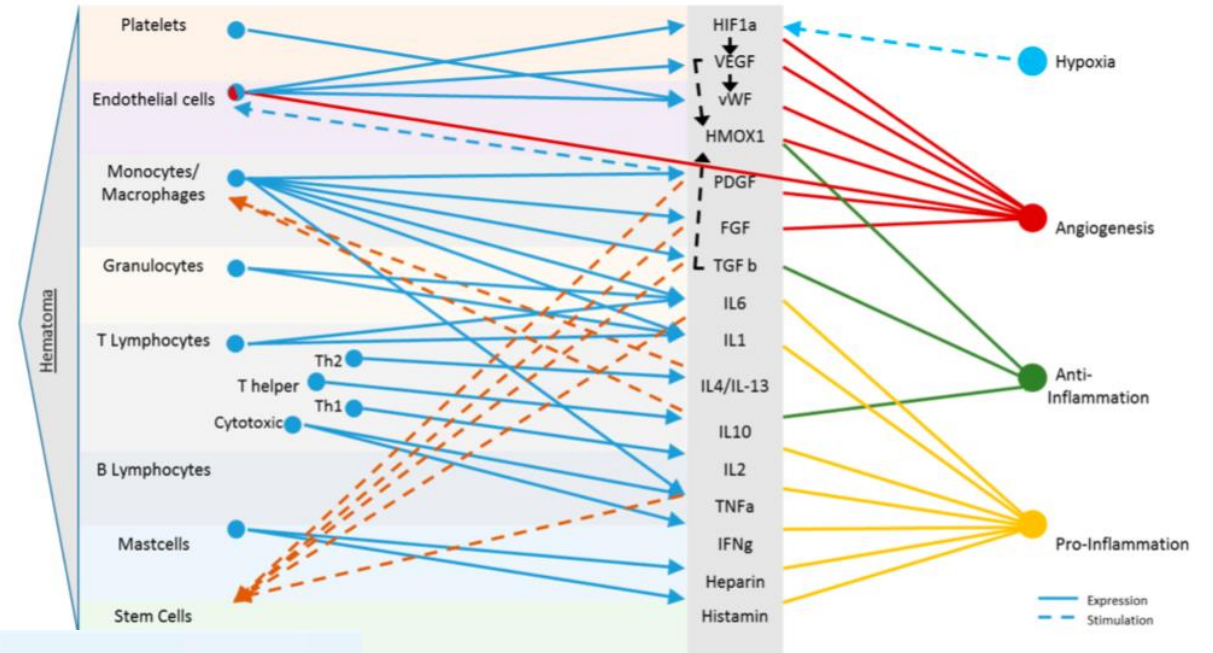


# Cytokines in **Heila**

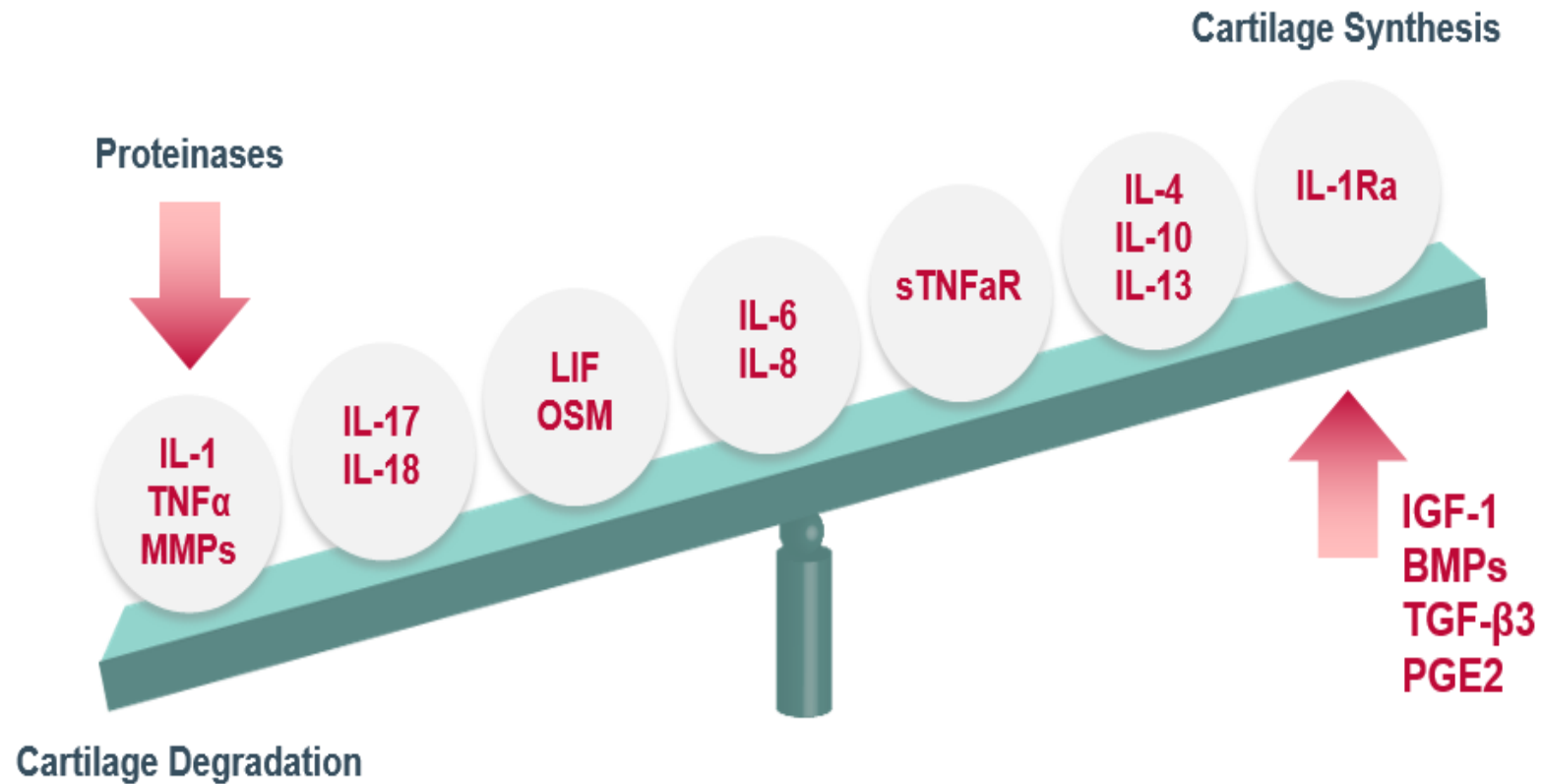
	Baseline		Coated	
	Mean	SD	Mean	SD
<b>IL1bRa</b>	345/9	146/3	12953	4090
<b>IL1b</b>	<3.9	<3.9	61/19	43/06
<b>IL4</b>	2/83	1/17	12/3	5/47
<b>IL6</b>	10/28	4/786	59/76	19/14
<b>IL8</b>	9/690	4/122	34/16	10/80
<b>IL10</b>	8/14	4/77	32/14	9/948
<b>IL13</b>	67/99	18/89	95/47	23/33
<b>EGF</b>	2/38	1/63	31/44	7/007
<b>TGFb</b>	22/88	15/69	177/1	66/54
<b>bFGF</b>	0/254	0/176	2/577	1/085
<b>IGF</b>	54/82	25/28	164/5	47/09
<b>PDGFAB</b>	2/57	1/71	40/71	10/20

Acti  
Go to  
Wind

# We Have the Master Key



# We Play with Injury



Wehling et al. „How does surgery compare with advanced intra-articular therapies in knee osteoarthritis: current thoughts“ in *Therapeutic advances in Musculoskeletal Disease*, June 2016, vol. 8 no. 3, p. 72-83

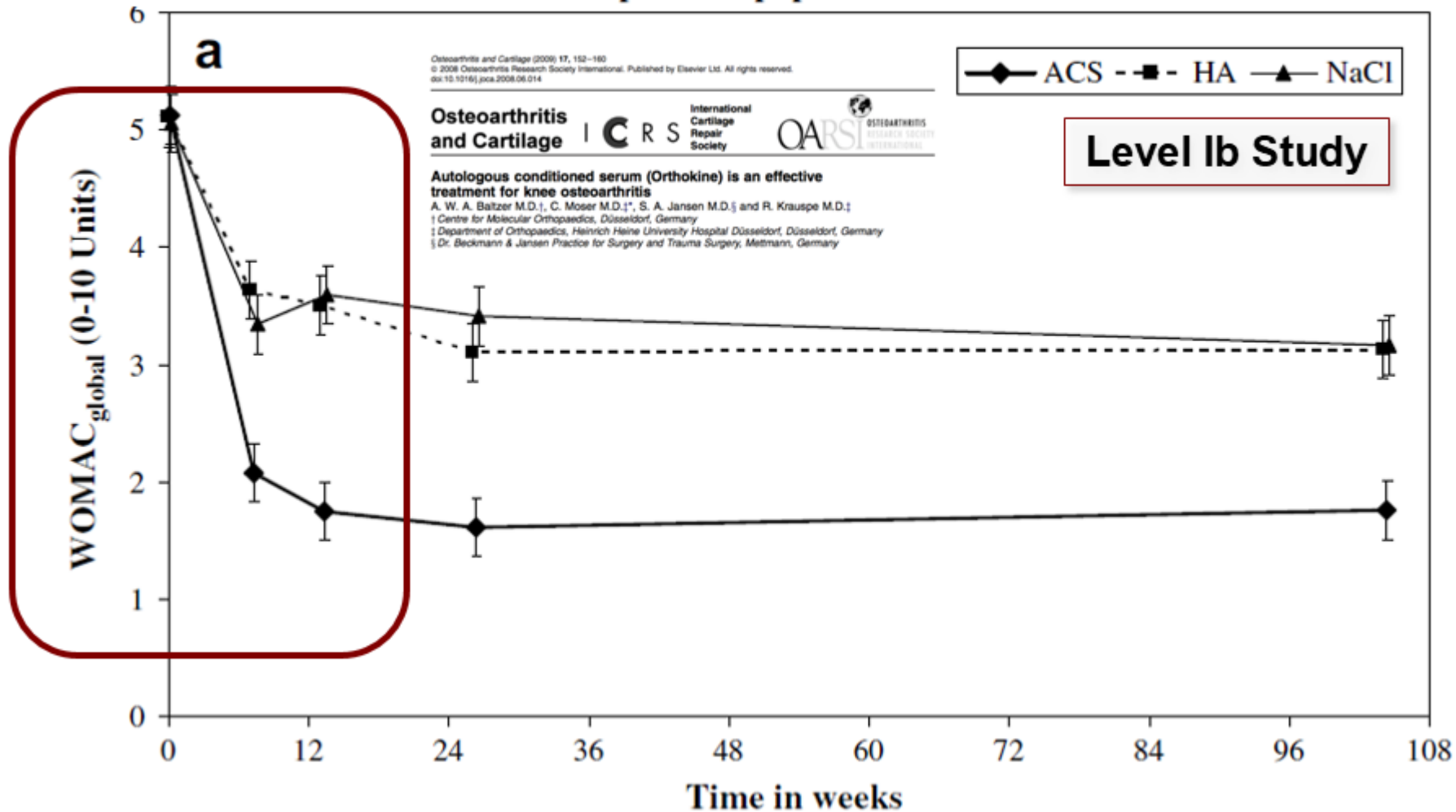
The screenshot shows the journal's homepage. At the top, there is a red header with the journal title "Therapeutic Advances in Musculoskeletal Disease" and a pill icon. Below the header is a navigation bar with buttons for "Home", "OnlineFirst", "All Issues", "Subscribe", "RSS", and "Email Alerts". A search bar is located on the right side of the navigation bar. Below the navigation bar, there is a grey box containing the journal's impact factor and indexing information: "Unofficial 2015 Impact Factor: 4.190, based on data from Thomson Reuters Web of Knowledge | Indexed in PubMed/PubMedCentral | Indexed in Emerging Sources Citation Index (ESCI): a new index in the Web of Science (TM) Core Collection". The main content area features the article title "How does surgery compare with advanced intra-articular therapies in knee osteoarthritis: current thoughts" in large, bold, black text. To the right of the title is a small icon of a right-pointing arrow. Further right, there are links for "« Previous | Next Article »" and "Table of Contents". Below these links is a section titled "This Article" with the following text: "Published online before print April 18, 2016, doi: 10.1177/1759720X16642405".

Intra-articular injection of ACS (Orthokine) has demonstrated **efficacy as a treatment for knee OA** in a number of studies, with a very low rate of adverse events and side effects, compared with surgery. Treatment with ACS utilizes the release of anti-inflammatory cytokines and regenerative growth factors to support the natural healing processes in the knee...



2009 Baltzer et al. „Orthokine is effective treatment or knee osteoarthritis,

Per-protocol population N = 188

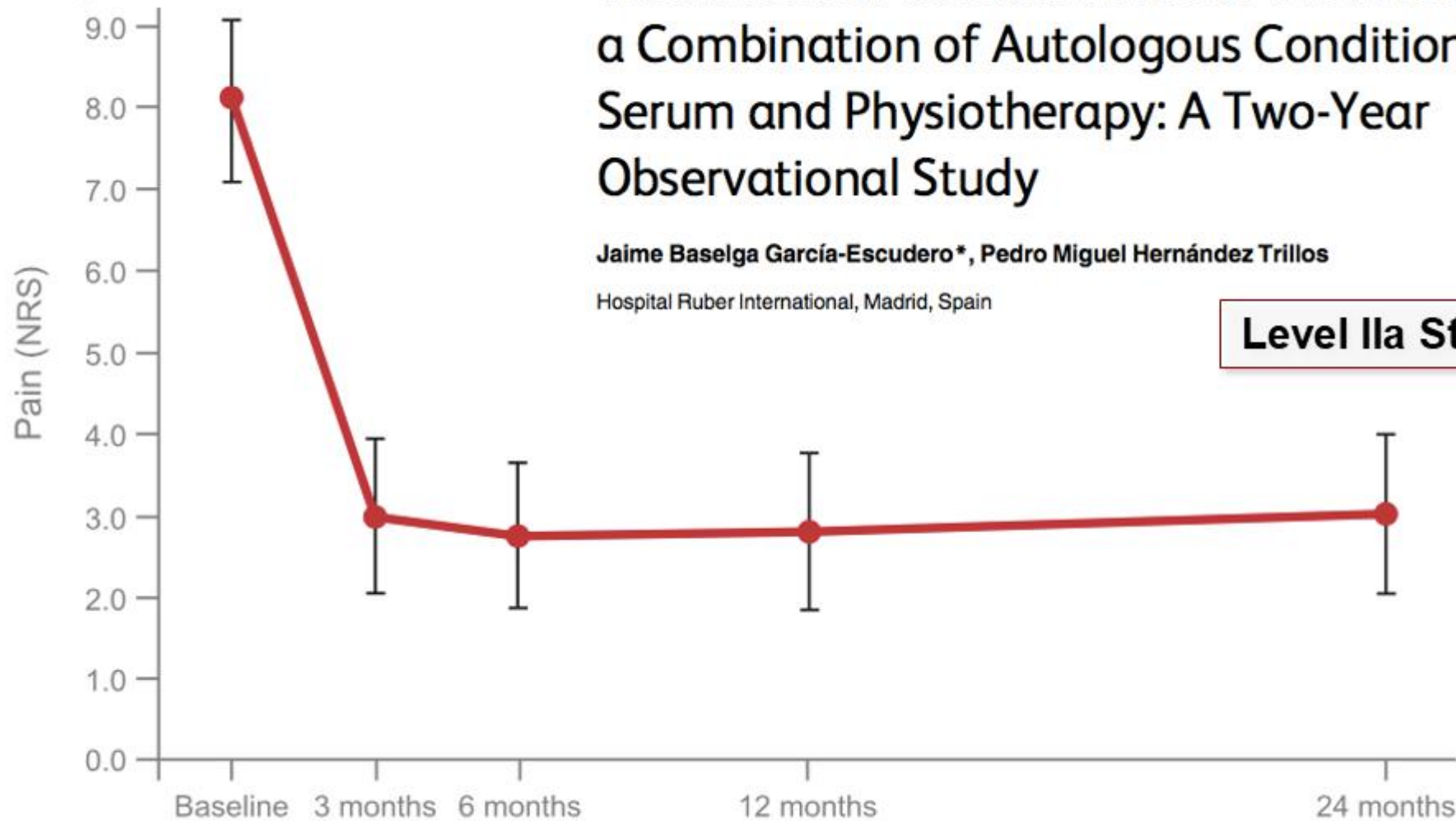


# Treatment of Osteoarthritis of the Knee with a Combination of Autologous Conditioned Serum and Physiotherapy: A Two-Year Observational Study

Jaime Baselga García-Escudero\*, Pedro Miguel Hernández Trillos

Hospital Ruber International, Madrid, Spain

**Level IIa Study**



**Fig 1. Pain (NRS) scores for baseline, 3, 6, 12 and 24 months after treatment with ACS and physiotherapy.** Error bars denote standard deviation. ACS: Autologous conditioned serum; NRS: Numeric Rating Scale.

# HeilaART in LBP

## ■ Efficacy of Epidural Perineural Injections With Autologous Conditioned Serum for Lumbar Radicular Compression

An Investigator-Initiated, Prospective, Double-Blind, Reference-Controlled Study

Level Ib Study

Cordelia Becker, MD,\* Stefan Heidersdorf, MD,† Sascha Drewlo, MSc,‡  
Sonja Zirke de Rodriguez,† Juergen Krämer, MD,† and Roland Ernst Willburger, MD§

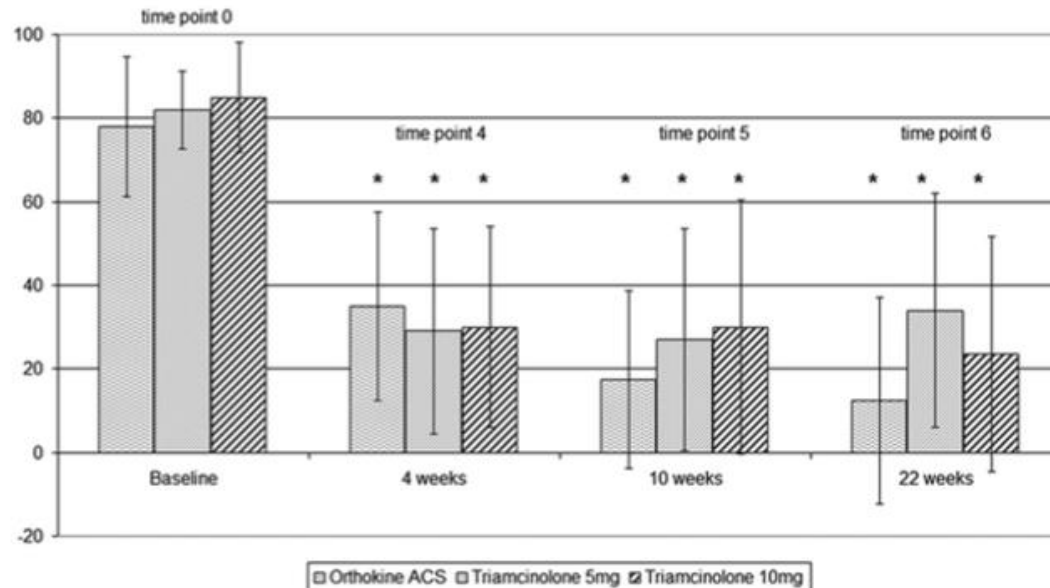


Figure 1. Results for the primary study endpoint. The pain intensity scores and the time curves for VAS are shown. Mean, SD, and median are given. \*Significant difference from baseline. Time schedule is given in weeks after the first injection.

# HeilaART in Discopathy

positive discography



before

3 intradiscal injections

after

30 mths later (painfree)

# HeilaART in Muscle injury

## Treatment of Muscle Injuries by Local Administration of Autologous Conditioned Serum: A Pilot Study on Sportsmen with Muscle Strains

T. Wright-Carpenter<sup>1,3</sup>  
P. Klein<sup>2</sup>  
P. Schäferhoff<sup>2</sup>  
H. J. Appell<sup>3</sup>  
L. M. Mir<sup>1</sup>  
P. Wehling<sup>4</sup>

Level Ib Study

Table 2 Recovery time after moderate muscle strains in professional sportsmen

<i>Strained muscle</i>	<i>Recovery time (days) in autologous conditioned serum group</i>	<i>Recovery time (days) in control Actovegin®/Traumeel® group</i>
<i>Hamstring</i>	12, 14, 16, 17, 18, 21	16, 18, 23, 24, 28
<i>Adductor</i>	10, 15, 17, 18, 21, 23	19, 24, 25, 26
<i>Iliopsoas</i>	17, 21	24
<i>Gluteus</i>	20	
<i>Abdominal oblique</i>	8	
<i>Gastrocnemius</i>	14	18
<i>Rectus femoris</i>	16	
<b>Mean</b>	16.6	22.3
<b>SE</b>	0.9	1.2

**ORIGINAL ARTICLE**

Iran J Allergy Asthma Immunol

In press.

## Effect of Dextrose Prolotherapy, Platelet Rich Plasma and Autologous Conditioned Serum on Knee Osteoarthritis: A Randomized Clinical Trial

Alireza Pishgahi<sup>1</sup>, Rozita Abolhasan<sup>2</sup>, Seyed Kazem Shakouri<sup>1</sup>, Mohammad Sadegh Soltani Zangbar<sup>2,3</sup>, Shahla Dareshiri<sup>1</sup>, Sepideh Ranjbar Kiyakalayeh<sup>1</sup>, Amirghasem Khoelilar<sup>4</sup>, Majid Zamani<sup>5</sup>, Farhad Motavalli Khiavi<sup>6</sup>, Behzad Pourabbas Kheiraddin<sup>7</sup>, and Mehdi Yousefi<sup>2,8</sup>

<sup>1</sup> Physical Medicine and Rehabilitation Research Center, Tabriz University of Medical Science, Tabriz, Iran

<sup>2</sup> Stem Cell Research Center, Tabriz University of Medical Science, Tabriz, Iran

<sup>3</sup> Student Research Committee, Tabriz University of Medical Sciences, Tabriz, Iran

<sup>4</sup> Stud Road Medical Centre, Dandenong, VIC, Australia

<sup>5</sup> Department of Medical Laboratory Sciences, Faculty of Allied Medicine, Gonabad University of Medical Sciences, Gonabad, Iran

<sup>6</sup> Medical Biotechnology Research Center, AJA University of Medical Sciences, Tehran, Iran

<sup>7</sup> Department of Polymer Engineering, Sahand University of Technology, Tabriz, Iran

<sup>8</sup> Department of Immunology, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

Received: 15 December 2019; Received in revised form: 10 April 2020; Accepted: 13 April 2020

### ABSTRACT

Knee osteoarthritis (OA) is one of the common degenerative articular disorders that are related to decreased quality of life. Currently, novel biologic therapeutic approaches are introduced in the literature for OA management. In this study, the clinical efficiency of Dextrose prolotherapy, platelet-rich plasma (PRP) and Autologous Conditioned Serum (ACS) injection on the level of pain and function in Knee OA were compared.

A randomized clinical trial was directed on 92 knee OA patients. Patients were randomly divided



# HeilaART in Osteoarthritis

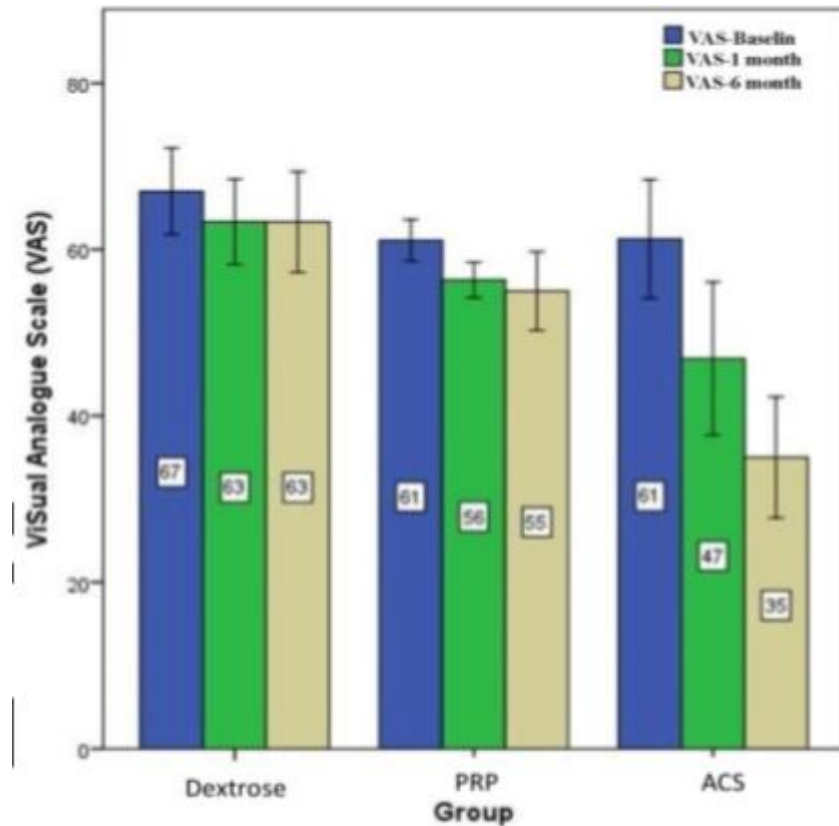
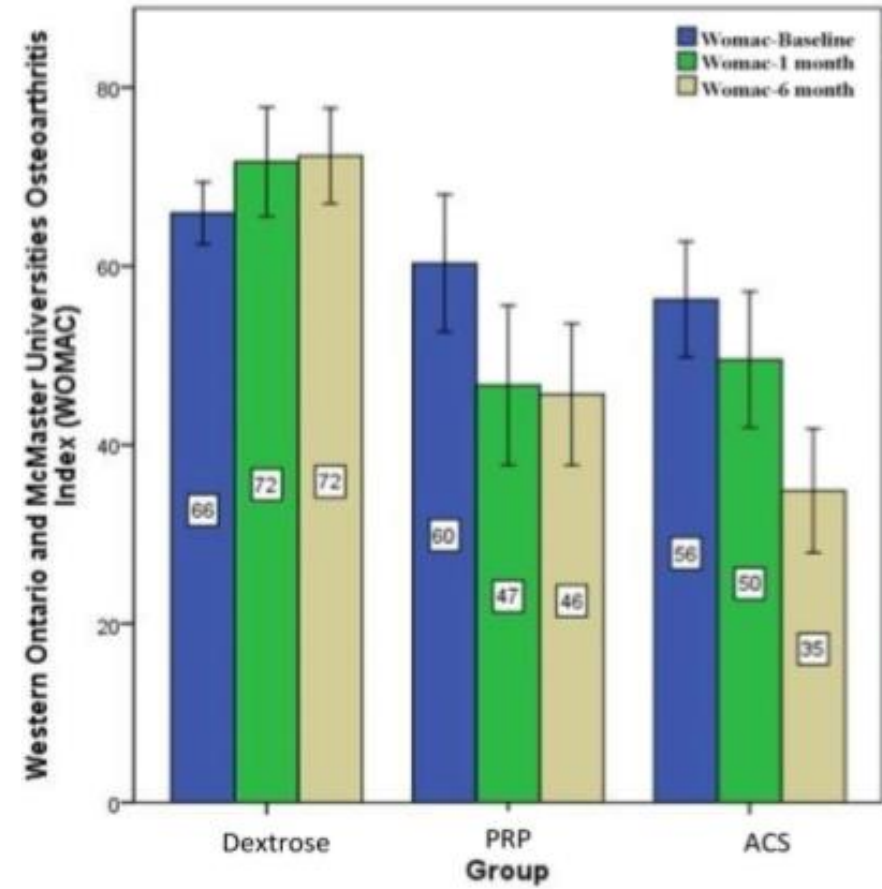
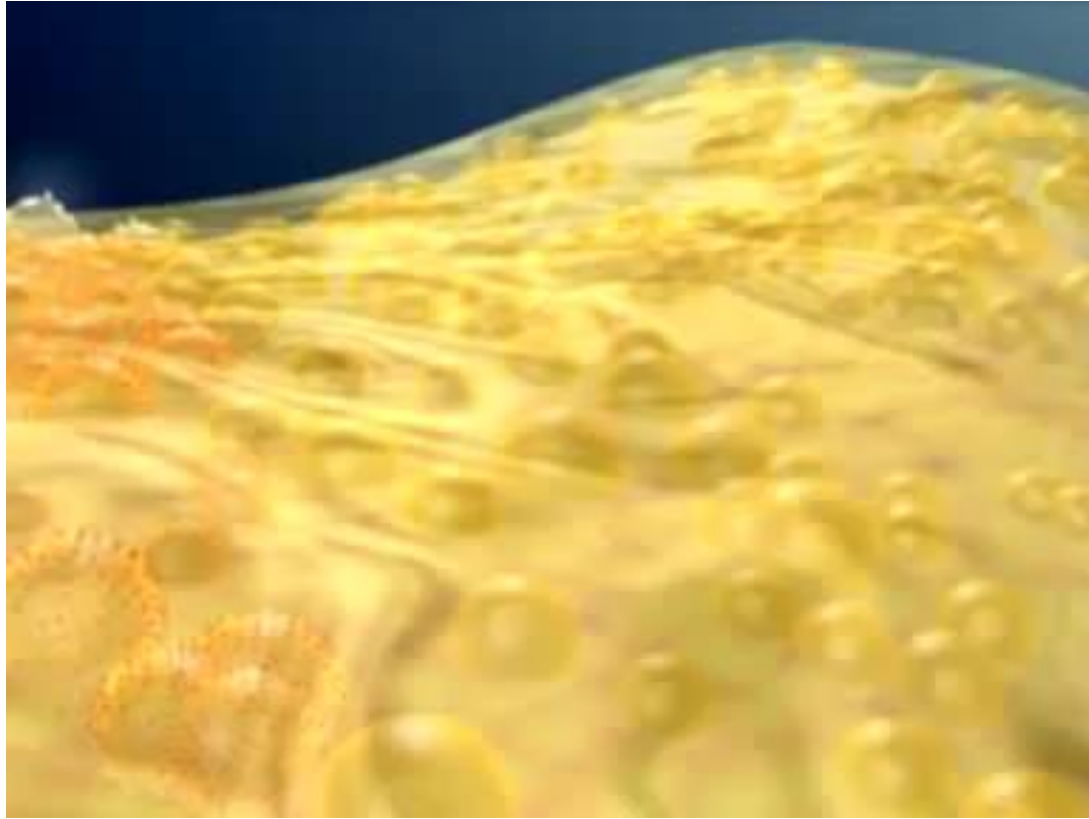


Figure 1. Knee pain outcome in participants. VAS: Visual analog Scale



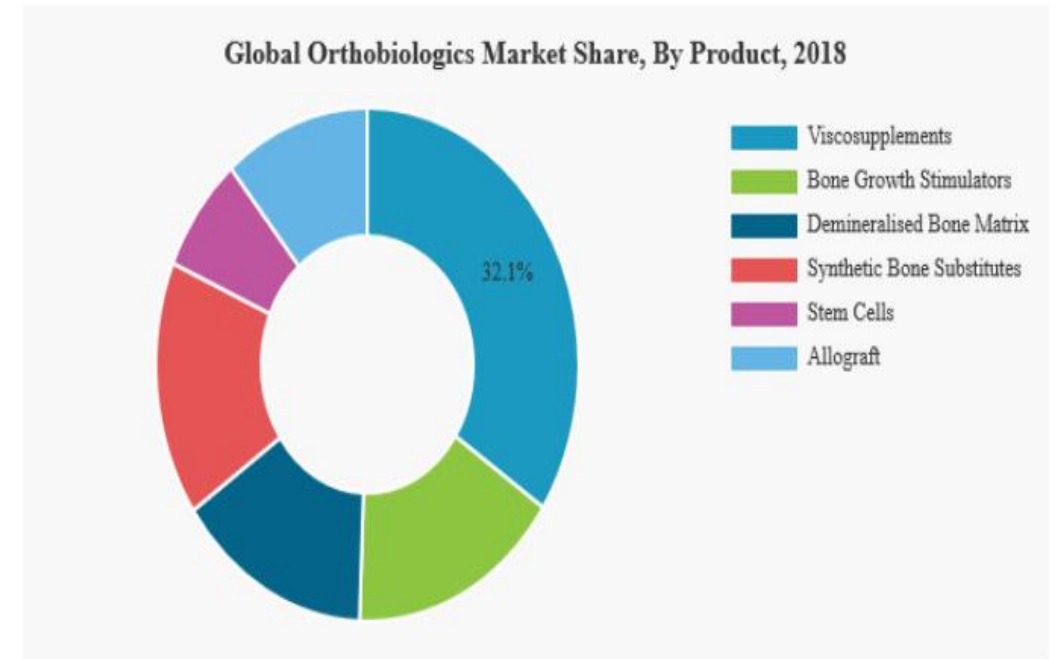
# HeilaART procedure





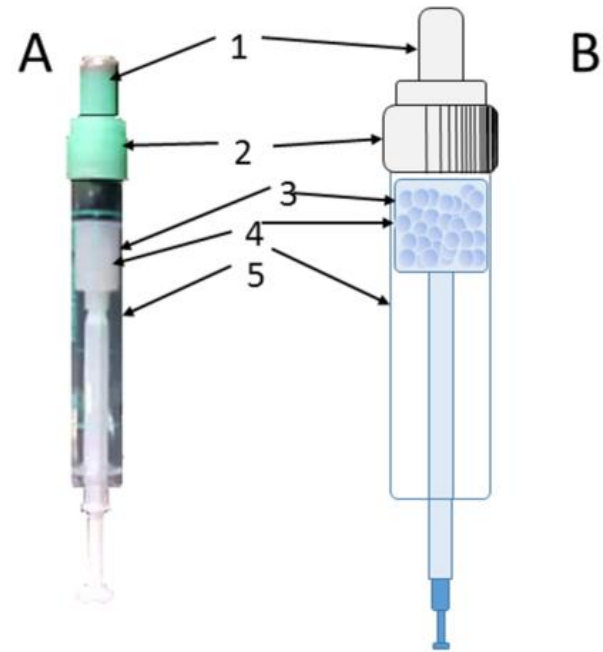
# HeilaART market Analysis

The global orthobiologics market size was USD 5,830 million in 2018 and is projected to reach USD 8,261.6 million in 2026.



# Heila Beauty

We Grow Your Potentials



# HeilaBeauty in literature

## The Potential of Topical and Injectable Growth Factors and Cytokines for Skin Rejuvenation

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<sup>1</sup>Goldman, Butterwick, Fitzpatrick, Groff & Fabi, Cosmetic Laser Dermatology, San Diego, California

<sup>2</sup>Department of Dermatology, University of California, San Diego, California

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Address for correspondence: Hema Sundaram, MD, Sundaram Dermatology, Cosmetic & Laser Surgery, 11119 Rockville Pike Suite 205, Rockville, MD 20852 (e-mail: hemasundaram@gmail.com).

Facial Plast Surg 2014;30:157–171.

### Abstract

Growth factors and cytokines (referred to collectively hereafter as GFs) control cell growth, proliferation, and differentiation via a network of inter and intracellular signaling pathways. There are striking parallels between the pathways involved in skin wound healing and those implicated in photoaging of the skin. In recent years, topical and injectable GFs have emerged as an intriguing therapeutic modality that can be harnessed for aesthetic and medical purposes. This article provides a review of available evidence for the role in skin regeneration of topical GFs, and of injectable GFs contained in autologous platelet-rich plasma (PRP). It presents data from recent studies of GFs, offers a discussion of their potential to serve as antiaging actives, and includes safety considerations. As studies of injectable GFs typically assume preexisting familiarity with PRP protocols and the theory behind them, explanatory notes are provided. An assessment is provided of the evidence gaps that exist currently between experimental observations regarding GFs and their proven clinical benefits. Data of evidence levels II

# HeilaBeauty in literature

Clinical, Cosmetic and Investigational Dermatology

Dovepress

open access to scientific and medical research

 Open Access Full Text Article

REVIEW

## Skin rejuvenation using cosmetic products containing growth factors, cytokines, and matrikines: a review of the literature

This article was published in the following Dove Press journal:  
Clinical, Cosmetic and Investigational Dermatology  
9 November 2016  
[Number of times this article has been viewed](#)

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Diana Nogueira Teixeira<sup>1,\*</sup>  
Phillip S Leventhal<sup>2</sup>

<sup>1</sup>Merz Pharmaceuticals GmbH,  
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<sup>2</sup>4Clinics, Paris, France

\*These authors contributed equally to  
this work

**Abstract:** Skin aging is primarily due to alterations in the dermal extracellular matrix, especially a decrease in collagen I content, fragmentation of collagen fibrils, and accumulation of amorphous elastin material, also known as elastosis. Growth factors and cytokines are included in several cosmetic products intended for skin rejuvenation because of their ability to promote collagen synthesis. Matrikines and matrikine-like peptides offer the advantage of growth factor-like activities but better skin penetration due to their much smaller molecular size. In this review, we summarize the commercially available products containing growth factors, cytokines, and matrikines for which there is evidence that they promote skin rejuvenation.

**Keywords:** cosmetics, skin, aging, growth factor, cytokine, matrikine

# HeilaBeauty in literature

## Skin anti-aging strategies

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Ruta Ganceviciene,<sup>1,†</sup> Aikaterini I. Liakou,<sup>2,†</sup> Athanasios Theodoridis,<sup>2,†</sup> Evgenia Makrantonaki<sup>2</sup> and Christos C. Zouboulis<sup>2,\*</sup>

<sup>1</sup>Centre of Dermatovenereology, Vilnius University Hospital Santariskiu Klinikos; Vilnius, Lithuania; <sup>2</sup>Departments of Dermatology, Venereology, Allergology and Immunology, Dessau Medical Center; Dessau, Germany

<sup>†</sup>These authors contributed equally to this work.

**Keywords:** aging, anti-aging, antioxidants, laser, peeling, fillers, botulinum toxin, hormone replacement therapy, cell regulators, prevention

Skin aging is a complex biological process influenced by a combination of endogenous or intrinsic and exogenous or extrinsic factors. Because of the fact that skin health and beauty is considered one of the principal factors representing overall “well-being” and the perception of “health” in humans, several anti-aging strategies have been developed during the last years. It is the intention of this article to review the most important anti-aging strategies that dermatologists have nowadays in hand, including including preventive measurements, cosmetological strategies, topical and systemic therapeutic agents, and invasive procedures.

will yield improvement in skin appearance and will speed wound healing.<sup>21</sup> A marked loss of fibrillin-positive structures<sup>22</sup> as well as a reduced content of collagen type VII (Col-7), may contribute to wrinkles by weakening the bond between dermis and epidermis of extrinsically age skin.<sup>23</sup> Sun-exposed aged skin is characterized by the solar elastosis. The sparse distribution and decrease in collagen content in photoaged skin can be due to increased collagen degradation by various matrix metalloproteinases, serine, and other proteases irrespective of the same collagen production.<sup>24-28</sup> In older skin, collagen looks irregular and disorganized, the ratio of Col-3, to Col-1 has been shown to increase, due, significantly, to a loss of Col-1.<sup>29</sup> The overall collagen content per

# HeilaBeauty in literature

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## Journal of Surgery

2015; 3(1-1): 1-5

Published online November 28, 2014 (<http://www.sciencepublishinggroup.com/j/js>)

doi: 10.11648/j.js.s.2015030101.11

ISSN: 2330-0914 (Print); ISSN: 2330-0930 (Online)

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## An autologous anti-aging serum confirms its beauty enhancer effect but its role as a chronic inflammation modulator is not clear

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### To cite this article:

Pinto Hernán, Garrido Gorgojo Luis. An Autologous Anti-Aging Serum Confirms Its Beauty Enhancer Effect but Its Role as a Chronic Inflammation Modulator is not Clear. *Journal of Surgery*. Special Issue: Breakthroughs in Aesthetic Medicine.

Vol. 3, No. 1-1, 2015, pp. 1-5. doi: 10.11648/j.js.s.2015030101.11

---

**Abstract:** There are many biological theories that claim to be the final explanation of aging, though actually it is well accepted that none of them provides an explanation that allows a full understanding of the complicated, multi-factorial, unavoidable and deleterious aging process. Inflammation can be considered a core process of aging and vice versa, aging is sometimes referred as a chronic inflammatory state condition. AAS is highly concentrated in some growth factors and anti-inflammatory cytokines like Interleukin-1 receptor antagonist (IL-1ra). Evidence suggested that AAS had two very well differentiated clinical effects: a systemic "anti-inflammatory-anti-aging" action and a local aesthetic action. To confirm the two effects with a multisession protocol and to assess a possible correlation between them were the aims of this work.

**Keywords:** Aging, Autologous Antiaging Serum (AAS), Beauty, Interleukin-6, C Reactive Protein, Chronic Inflammation

# HeilaBeauty procedure

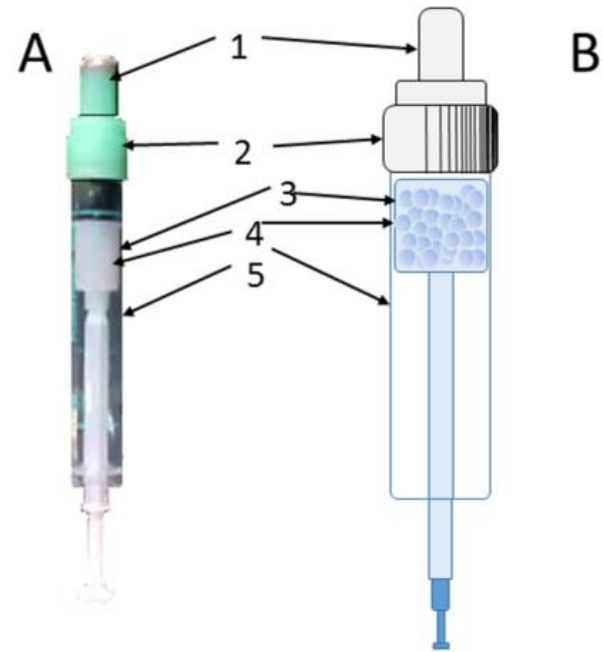






# HeilaDerm

We Grow Your Potentials



# HeilaDerm in literature

PERSPECTIVE ARTICLE

## Growth factors and cytokines in wound healing

Stephan Barrientos<sup>1,2</sup>; Olivera Stojadinovic, MD<sup>2</sup>; Michael S. Golinko, MD<sup>3</sup>; Harold Brem, MD<sup>3</sup>; Marjana Tomic-Canic, PhD<sup>2,4</sup>

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Manuscript received: January 14, 2008

Accepted in final form: May 31, 2008

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### ABSTRACT

Wound healing is an evolutionarily conserved, complex, multicellular process that, in skin, aims at barrier restoration. This process involves the coordinated efforts of several cell types including keratinocytes, fibroblasts, endothelial cells, macrophages, and platelets. The migration, infiltration, proliferation, and differentiation of these cells will culminate in an inflammatory response, the formation of new tissue and ultimately wound closure. This complex process is executed and regulated by an equally complex signaling network involving numerous growth factors, cytokines and chemokines. Of particular importance is the epidermal growth factor (EGF) family, transforming growth factor beta (TGF- $\beta$ ) family, fibroblast growth factor (FGF) family, vascular endothelial growth factor (VEGF), granulocyte macrophage colony stimulating factor (GM-CSF), platelet-derived growth factor (PDGF), connective tissue growth factor (CTGF), interleukin (IL) family, and tumor necrosis factor- $\alpha$  family. Currently, patients are treated by three growth factors: PDGF-BB, bFGF, and GM-CSF. Only PDGF-BB has successfully completed randomized clinical trials in the United States. With gene therapy now in clinical trial and the discovery of biodegradable polymers, fibrin mesh, and human collagen serving as potential delivery systems other growth factors may soon be available to patients. This review will focus on the specific roles of these growth factors and cytokines during the wound healing process.

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## Clinical Application of Growth Factors and Cytokines in Wound Healing

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### Abstract

Wound healing is a complex and dynamic biological process that involves the coordinated efforts of multiple cell types and is executed and regulated by numerous growth factors and cytokines. There has been a drive in the past two decades to study the therapeutic effects of various growth factors in the clinical management of non-healing wounds (e.g. pressure ulcers, chronic venous ulcers, diabetic foot ulcers). For this review, we conducted a nonlinear search of Medline and PubMed and critically analyzed the literature regarding the role of growth factors and cytokines in the management of these wounds. We focused on currently approved therapies, emerging therapies and future research possibilities. In this review we discuss four growth factors and cytokines currently being used on and off label for the healing of wounds. These include: granulocyte-macrophage colony stimulating factor (GM-CSF), platelet derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and basic fibroblast growth factor (bFGF). While the clinical results of using growth factors and cytokines are encouraging, many studies involved a small sample size and are disparate in measured endpoints. Therefore, further research

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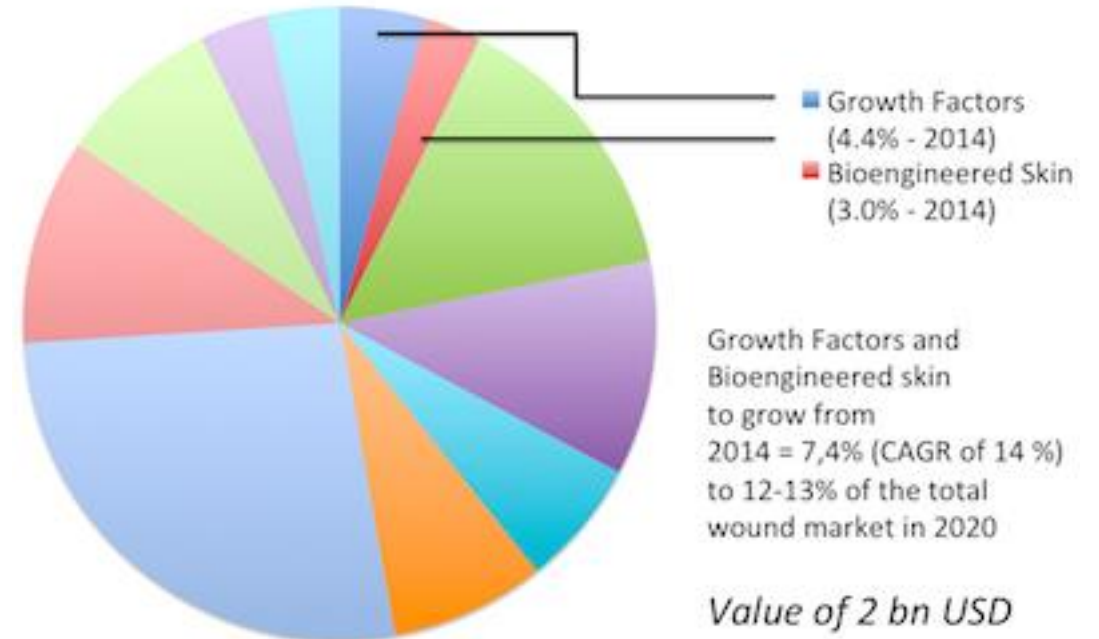
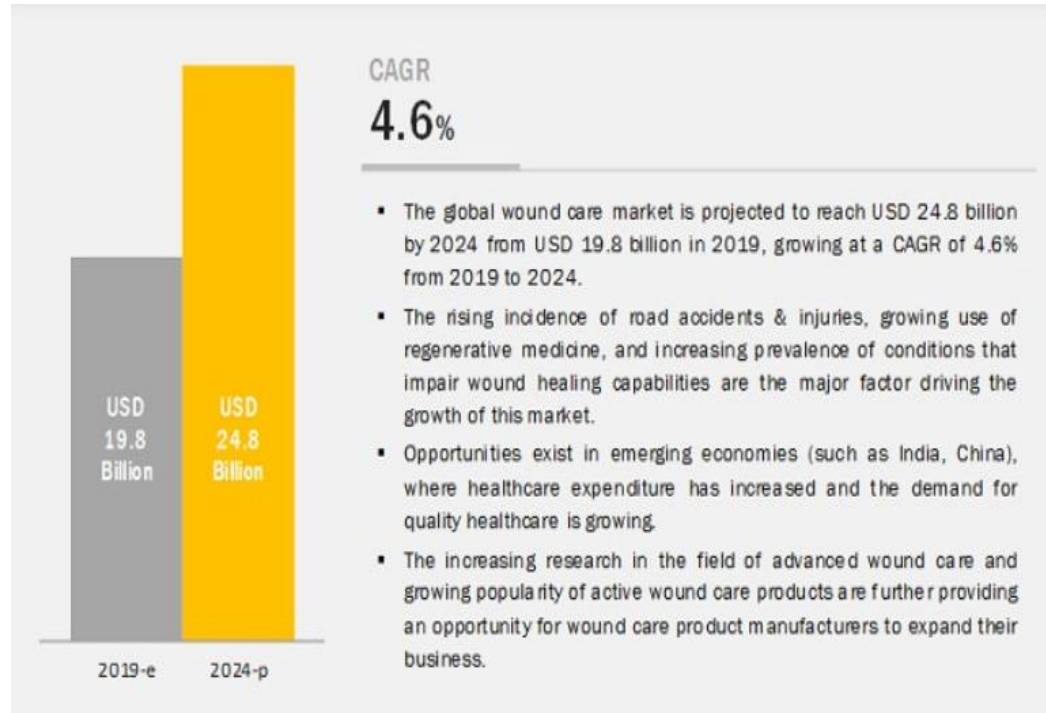
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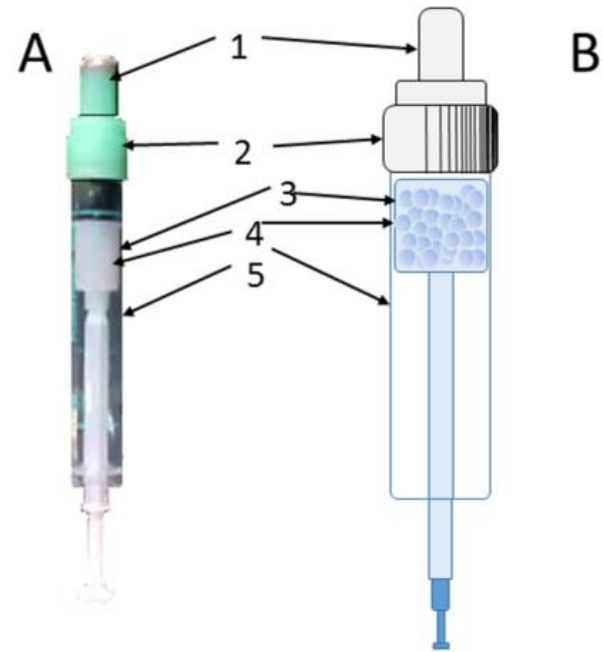
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RESEARCH ARTICLE

## Effects of Autologous Platelet-Rich Plasma on Endometrium Thickness and Pregnancy Rates During Intrauterine Insemination

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### Abstract

**Objective:** Evaluation of the effect of platelet-rich plasma (PRP) on the endometrium and pregnancy outcomes in patients undergoing insemination due to unexplained infertility.

**Methods:** 24 patients who were admitted to the clinic due to unexplained infertility, analyzed retrospectively between March 2018 and October 2018. Gonadotropin induction was initiated on day 3 of the cycle for follicular growth. Human chorionic gonadotropin (hCG) was applied for ovulation induction at the point that at least 1 follicle that is over 16 mm was detected by transvaginal ultrasound. 17.5 ml of blood from the patient's venous system was drawn for the preparation of the PRP which includes 4-5 times more platelets than regular blood. PRP was administered to 12 patients (Group 1) on the hCG day, while hCG was solely administered to the other group (Group 2) and both groups were inseminated 36 hours later.

**Results:** The demographic properties of all patients were determined as follows: mean age; 29.13 years old ( $\pm 3.4$ ), mean infertility period; 1.96 years ( $\pm 1.08$ ), mean ovulation induction period; 7.92 days ( $\pm 1.76$ ), mean antral follicle count; 14.54 ( $\pm 6.56$ ), mean dominant follicle count; 2.04 ( $\pm 0.75$ ). Although there was no significant difference between the groups in terms of clinical pregnancy (3/12 vs 2/12,  $p = 0.623$ ), the change in endometrial thickness was significantly higher in the PRP administered group (1.95 mm vs 0.44 mm,  $p < 0.001$ ).

**Conclusion:** PRP application before the insemination seems promising for the preparation of the endometrium in patients having an inadequate endometrial thickness or in patients experiencing recurrent implantation failure.

**Key words:** Intrauterine insemination, endometrial thickness, autologous platelet-rich plasma, infertility, pregnancy rate

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Review article

## Intrauterine infusion of autologous platelet-rich plasma in women undergoing assisted reproduction: A systematic review and meta-analysis



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### ARTICLE INFO

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PRP  
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Sperm injections  
Intracytoplasmic

### ABSTRACT

Prior studies have provided conflicting results regarding the use of platelet-rich plasma (PRP) in women undergoing in-vitro fertilization (IVF) or intracytoplasmic injection (ICSI). The objective of this study was to evaluate the effect of the intrauterine infusion of PRP on the outcome of embryo transfer (ET) in women undergoing IVF/ICSI. We searched databases, including PubMed, Embase, Scopus, Web of Science, and the Cochrane Database of Clinical Trials (CENTRAL). Meta-analysis using a random-effects model was performed to calculate the pooled estimates. Seven studies involving 625 patients (311 cases and 314 controls) were included. The probability of chemical pregnancy ( $n = 3$ , risk ratio (RR): 1.79, 95 % confidence intervals (CI): 1.29, 2.50;  $P < 0.001$ ,  $I^2 = 0\%$ ), clinical pregnancy ( $n = 7$ , RR: 1.79, 95 % CI: 1.37, 2.32;  $P < 0.001$ ,  $I^2 = 16\%$ ), and implantation rate ( $n = 3$ , RR: 1.97, 95 % CI: 1.40, 2.79;  $P < 0.001$ ,  $I^2 = 0\%$ ) was significantly higher in women who received PRP compared with control. There was no difference between women who received PRP compared with control group regarding miscarriage (RR: 0.72, 95 % CI: 0.27, 1.93;  $P = 0.51$ ,  $I^2 = 0\%$ ). Following the intervention, endometrial thickness increased in women who received PRP compared to control group (SMD: 1.79, 95 % CI: 1.13, 2.44;  $P < 0.001$ ,  $I^2 = 64\%$ ). The findings of this systematic review suggest that PRP is an alternative treatment strategy in patients with thin endometrium and recurrent implantation failure (RIF). Further prospective, large, and high quality randomized controlled trials (RCTs) are needed to identify the subpopulation that would most benefit from PRP.

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## Global In Vitro Fertilization (IVF) Market





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