

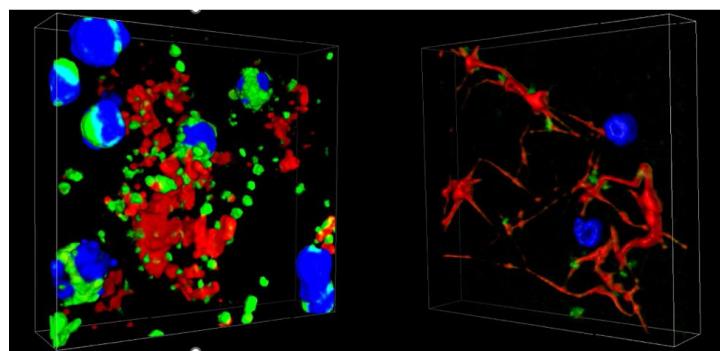


The Arnold I. Caplan Award for Distinguished Research in OrthoBiologics

Platelet-rich plasma for the treatment of knee osteoarthritis: Bench to bedside

A 360° evidence-based approach to translate

the potential of blood derivatives in clinical practice



Giuseppe Filardo, MD, PhD, MBA

Professor at the Faculty of Biomedical Sciences, USI, Switzerland

Head of Clinical Research

Department of Surgery, Orthopaedics and Traumatology, EOC, Switzerland

About the author

<https://www.researcharchitect.org>

<https://www.linkedin.com/in/giuseppe-filardo/>



Milestone articles

Perut F, Filardo G, Mariani E, Cenacchi A, Pratelli L, Devescovi V, Kon E, Marcacci M, Facchini A, Baldini N, Granchi D.

Preparation method and growth factor content of platelet concentrate influence the osteogenic differentiation of bone marrow stromal cells.

Cytotherapy. 2013 Jul;15(7):830-839.

Assirelli E, Filardo G, Mariani E, Kon E, Roffi A, Vaccaro F, Marcacci M, Facchini A, Pulsatelli L.
Effect of two different preparations of platelet-rich plasma on synoviocytes.

Knee Surg Sports Traumatol Arthrosc. 2015 Sep;23(9):2690-2703.

Cavallo C, Roffi A, Grigolo B, Mariani E, Pratelli L, Merli G, Kon E, Marcacci M, Filardo G.
Platelet-Rich Plasma: The Choice of Activation Method Affects the Release of Bioactive Molecules.
Biomed Res Int. 2016:6591717.

Veronesi F, Pagani S, Torricelli P, Filardo G, Cavallo C, Grigolo B, Fini M.
PRP and MSCs on tenocytes artificial wound healing: an in vitro study comparing fresh and frozen PRP.
Histol Histopathol. 2018 Dec;33(12):1323-1334.

Mariani E, Roffi A, Cattini L, Pulsatelli L, Assirelli E, Krishnakumar GS, Cenacchi A, Kon E, Filardo G.

Release kinetic of pro- and anti-inflammatory biomolecules from platelet-rich plasma and functional study on osteoarthritis synovial fibroblasts.

Cytotherapy. 2020 Jul;22(7):344-353.

Pagani S, Veronesi F, Giavaresi G, Filardo G, Papiò T, Romandini I, Fini M.

Autologous Protein Solution Effect on Chondrogenic Differentiation of Mesenchymal Stem Cells from Adipose Tissue and Bone Marrow in an Osteoarthritic Environment.

Cartilage. 2021 Dec;13(2_suppl):225S-237S.

Boffa A, Salerno M, Merli G, De Girolamo L, Laver L, Magalon J, Sánchez M, Tischer T, Filardo G.

Platelet-rich plasma injections induce disease-modifying effects in the treatment of osteoarthritis in animal models.

Knee Surg Sports Traumatol Arthrosc. 2021 Dec;29(12):4100-4121.

Mariani E, Pulsatelli L, Cattini L, Assirelli E, Cenacchi A, Di Martino A, Arciola CR, Filardo G.

Pure Platelet and Leukocyte-Platelet-Rich Plasma for Regenerative Medicine in Orthopedics-Time- and Preparation-Dependent Release of Growth Factors and Effects on Synovial Fibroblasts: A Comparative Analysis.

Int J Mol Sci. 2023 Jan 12;24(2):1512.

Kon E, Buda R, Filardo G, Di Martino A, Timoncini A, Cenacchi A, Fornasari PM, Giannini S, Marcacci M.

Platelet-rich plasma: intra-articular knee injections produced favorable results on degenerative cartilage lesions.

Knee Surg Sports Traumatol Arthrosc. 2010 Apr;18(4):472-479.

Kon E, Mandelbaum B, Buda R, Filardo G, Delcogliano M, Timoncini A, Fornasari PM, Giannini S, Marcacci M.

Platelet-Rich Plasma Intra-Articular Injection Versus Hyaluronic Acid Viscosupplementation as Treatments for Cartilage Pathology: From Early Degeneration to Osteoarthritis.
Arthroscopy. 2011 Nov;27(11):1490-1501.

Filardo G, Kon E, DI Matteo B, DI Marino A, Sessa A, Merli ML, Marcacci M.

Leukocyte-poor PRP application for the treatment of knee osteoarthritis.
Joints. 2014 Jan 8;1(3):112-120.

Di Martino A, Di Matteo B, Papi T, Tentoni F, Selleri F, Cenacchi A, Kon E, Filardo G.

Platelet-Rich Plasma Versus Hyaluronic Acid Injections for the Treatment of Knee Osteoarthritis: Results at 5 Years of a Double-Blind, Randomized Controlled Trial.

Am J Sports Med. 2019 Feb;47(2):347-354.

Altamura SA, Di Martino A, Andriolo L, Boffa A, Zaffagnini S, Cenacchi A, Zagarella MS,

Filardo G.

Platelet-Rich Plasma for Sport-Active Patients with Knee Osteoarthritis: Limited Return to Sport.

Biomed Res Int. 2020 Jan 31;2020:8243865.

Filardo G, Previtali D, Napoli F, Candrian C, Zaffagnini S, Grassi A.

PRP Injections for the Treatment of Knee Osteoarthritis: A Meta-Analysis of Randomized Controlled Trials.

Cartilage. 2021 Dec;13(1_suppl):364S-375S.

Mazzotta A, Pennello E, Stagni C, Del Piccolo N, Boffa A, Cenacchi A, Buzzi M, Filardo G, Dallari D.

Umbilical Cord PRP vs. Autologous PRP for the Treatment of Hip Osteoarthritis.

J Clin Med. 2022 Aug 2;11(15):4505.

Zaffagnini S, Andriolo L, Boffa A, Poggi A, Cenacchi A, Busacca M, Kon E, Filardo G, Di Martino A.

Microfragmented Adipose Tissue Versus Platelet-Rich Plasma for the Treatment of Knee Osteoarthritis.

Am J Sports Med. 2022 Sep;50(11):2881-2892.

Reale D, Feltri P, Franceschini M, de Girolamo L, Laver L, Magalon J, Sanchez M, Tischer T,

Filardo G.

Biological intra-articular augmentation for osteotomy in knee osteoarthritis: strategies and results : A systematic review of the literature from the ESSKA Orthobiologics Initiative.

Knee Surg Sports Traumatol Arthrosc. 2023 Oct;31(10):4327-4346.

Lo Presti M, Costa GG, Agrò G, Vasco C, Boffa A, Di Martino A, Andriolo L, Cenacchi A, Zaffagnini S, Filardo G.

Platelet-Rich Plasma Injections Do Not Improve the Recovery After Arthroscopic Partial Meniscectomy: A Double-Blind Randomized Controlled Trial.

Am J Sports Med. 2024 Nov;52(13):3198-3205.

Filardo G, Kon E, Pereira Ruiz MT, Vaccaro F, Guitaldi R, Di Martino A, Cenacchi A, Fornasari PM, Marcacci M.

Platelet-rich plasma intra-articular injections for cartilage degeneration and osteoarthritis: single- versus double-spinning approach.

Knee Surg Sports Traumatol Arthrosc. 2012 Oct;20(10):2082-2091.

Mariani E, Canella V, Berlingeri A, Bielli A, Cattini L, Landini MP, Kon E, Marcacci M, Di Matteo B, Filardo G.

Leukocyte presence does not increase microbicidal activity of Platelet-rich Plasma in vitro.

BMC Microbiol. 2015 Jul 30;15:149.

Mariani E, Canella V, Cattini L, Kon E, Marcacci M, Di Matteo B, Pulsatelli L, Filardo G.

Leukocyte-Rich Platelet-Rich Plasma Injections Do Not Up-Modulate Intra-Articular Pro-Inflammatory Cytokines in the Osteoarthritic Knee.

PLoS One. 2016 Jun 3;11(6):e0156137.

Kon E, Engebretsen L, Verdonk P, Nehrer S, Filardo G.

Clinical Outcomes of Knee Osteoarthritis Treated With an Autologous Protein Solution Injection: A 1-Year Pilot Double-Blinded Randomized Controlled Trial.

Am J Sports Med. 2018 Jan;46(1):171-180.

Kon E, Engebretsen L, Verdonk P, Nehrer S, Filardo G.

Autologous Protein Solution Injections for the Treatment of Knee Osteoarthritis: 3-Year Results.

Am J Sports Med. 2020 Sep;48(11):2703-2710.

Di Martino A, Boffa A, Andriolo L, Romandini I, Altamura SA, Cenacchi A, Roverini V, Zaffagnini S, Filardo G.

Leukocyte-Rich versus Leukocyte-Poor Platelet-Rich Plasma for the Treatment of Knee Osteoarthritis: A Double-Blind Randomized Trial.

Am J Sports Med. 2022 Mar;50(3):609-617.

Filardo G, Kon E.

PRP: Product Rich in Placebo?

Knee Surg Sports Traumatol Arthrosc. 2016 Dec;24(12):3702-3703.

Previtali D, Andriolo L, Di Laura Frattura G, Boffa A, Candrian C, Zaffagnini S, Filardo G.

Pain Trajectories in Knee Osteoarthritis-A Systematic Review and Best Evidence Synthesis on Pain Predictors.

J Clin Med. 2020 Sep 1;9(9):2828.

Previtali D, Merli G, Di Laura Frattura G, Candrian C, Zaffagnini S, Filardo G.

The Long-Lasting Effects of "Placebo Injections" in Knee Osteoarthritis: A Meta-Analysis.

Cartilage. 2021 Dec;13(1_suppl):185S-196S.

Boffa A, Andriolo L, Franceschini M, Martino AD, Asunis E, Grassi A, Zaffagnini S, Filardo G.

Minimal Clinically Important Difference and Patient Acceptable Symptom State in Patients With Knee Osteoarthritis Treated With PRP Injection.

Orthop J Sports Med. 2021 Oct 5;9(10):23259671211026242.

Previtali D, Boffa A, Di Martino A, Deabate L, Delcogliano M, Filardo G.

Recall Bias Affects Pain Assessment in Knee Osteoarthritis: A Pilot Study.

Cartilage. 2022 Dec;13(4):50-58.

Previtali D, Capone G, Marchettini P, Candrian C, Zaffagnini S, Filardo G.

High Prevalence of Pain Sensitization in Knee Osteoarthritis: A Meta-Analysis with Meta-Regression.

Cartilage. 2022 Jan-Mar;13(1):19476035221087698.

Franceschini M, Boffa A, Pignotti E, Andriolo L, Zaffagnini S, Filardo G.

The Minimal Clinically Important Difference Changes Greatly Based on the Different Calculation Methods.

Am J Sports Med. 2023 Mar;51(4):1067-1073.

Franceschini M, Boffa A, Di Martino A, Pignotti E, Andriolo L, Zaffagnini S, Filardo G.

The minimal clinically important difference changes greatly based on the patient's baseline clinical status.

J Exp Orthop 2025 Feb 10;12(1):e70137.

De Marziani L, Boffa A, Di Martino A, Andriolo L, Reale D, Bernasconi A, Corbo VR, de Caro F, Delcogliano M, di Laura Frattura G, Di Vico G, Manunta AF, Russo A, Filardo G.

The reimbursement system can influence the treatment choice and favor joint replacement versus other less invasive solutions in patients affected by osteoarthritis.

J Exp Orthop. 2023 Dec 23;10(1):146.

Perdisa F, Bordini B, Salerno M, Traina F, Zaffagnini S, Filardo G.

Total Knee Arthroplasty (TKA): When Do the Risks of TKA Overcome the Benefits? Double Risk of Failure in Patients up to 65 Years Old.

Cartilage. 2023 Sep;14(3):305-311.

Albanese J, Feltri P, Boffa A, Werner BC, Traina F, Filardo G.

Infection Risk Increases After Total Hip Arthroplasty Within 3 Months Following Intra-Articular Corticosteroid Injection. A Meta-Analysis on Knee and Hip Arthroplasty.

J Arthroplasty. 2023 Jun;38(6):1184-1193.

Bensa A, Albanese J, Boffa A, Previtali D, Filardo G.

Intra-articular corticosteroid injections provide a clinically relevant benefit compared to placebo only at short-term follow-up in patients with knee osteoarthritis: A systematic review and meta-analysis.

Knee Surg Sports Traumatol Arthrosc. 2024 Feb;32(2):311-322.

Bensa A, Salerno M, Boffa A, de Girolamo L, Laver L, Magalon J, Sánchez M, Tischer T, Filardo G.

Corticosteroid injections for the treatment of osteoarthritis present a wide spectrum of effects ranging from detrimental to disease-modifying: A systematic review of preclinical evidence by the ESSKA Orthobiologic Initiative.

Knee Surg Sports Traumatol Arthrosc. 2024 Nov;32(11):2725-2745.

Bensa A, Sangiorgio A, Boffa A, Salerno M, Moraca G, Filardo G.

Corticosteroid injections for knee osteoarthritis offer clinical benefits similar to hyaluronic acid and lower than platelet-rich plasma: a systematic review and meta-analysis.

EFORT Open Rev. 2024 Sep 2;9(9):883-895.

Boffa A, Moraca G, Sangiorgio A, Di Martino A, Bensa A, Filardo G.

Corticosteroids versus platelet-rich plasma injections for knee osteoarthritis: Where is there more evidence? A systematic review of 60 years of literature.

Knee. 2025 Aug;55:104-111.

Bensa A, Bianco Prevot L, Moraca G, Sangiorgio A, Boffa A, Filardo G

Corticosteroids, hyaluronic acid, platelet-rich plasma, and cell-based therapies for knee osteoarthritis - literature trends are shifting in the injectable treatments' evidence: a systematic review and expert opinion.

Expert Opin Biol Ther. 2025 Mar;25(3):309-318.

Bianco Prevot L, Bensa A, Peretti G, Filardo G.

Symptoms predict total knee arthroplasty more than osteoarthritis severity: A multivariable analysis of more than 7500 knees.

Knee Surg Sports Traumatol Arthrosc. 2025 Jun;33(6):2230-2236.

Boffa A, Poggi A, Romandini I, Asunis E, Pizzuti V, Di Martino A, Zaffagnini S, Filardo G.

Does Bone Marrow Edema Influence the Clinical Results of Intra-Articular Platelet-Rich Plasma Injections for Knee Osteoarthritis?.

J Clin Med. 2022 Jul 29;11(15):4414.

Kon E, Di Matteo B, Delgado D, Cole BJ, Dorotei A, Dragoo JL, Filardo G, Fortier LA, Giuffrida A, Jo CH, Magalon J, Malanga GA, Mishra A, Nakamura N, Rodeo SA, Samspon S, Sánchez M.

Platelet-rich plasma for the treatment of knee osteoarthritis: an expert opinion and proposal for a novel classification and coding system.

Expert Opin Biol Ther. 2020 Dec;20(12):1447-1460.

Laver L, Filardo G, Sanchez M, Magalon J, Tischer T, Abat F, Bastos R, Cugat R, Iosifidis M, Kocaoglu B, Kon E, Marinescu R, Ostoicic M, Beaufils P, de Girolamo L; ESSKA-ORBIT Group.

The use of injectable orthobiologics for knee osteoarthritis: A European ESSKA-ORBIT consensus. Part 1-Blood-derived products (platelet-rich plasma).

Knee Surg Sports Traumatol Arthrosc. 2024 Apr;32(4):783-797.

Kon E, Anzillotti G, Conte P, Ruosi L, Cole B, Dragoo J, Zaslav K, Frank R, De Girolamo L, Mandelbaum B, Rodeo S, Marcacci M, Filardo G, Di Matteo B.

The chimera of reaching a universal consensus on platelet-rich plasma treatment for knee osteoarthritis: a review of recent consensus statements and expert opinion.

Expert Opin Biol Ther. 2024 Aug;24(8):827-833.

Bensa A, Previtali D, Sangiorgio A, Boffa A, Salerno M, Filardo G.

PRP Injections for the Treatment of Knee Osteoarthritis: The Improvement Is Clinically Significant and Influenced by Platelet Concentration: A Meta-analysis of Randomized Controlled Trials.

Am J Sports Med. 2025 Mar;53(3):745-754.