

Chondro-Gide®
Turns 20

Architects of Regeneration

Spaces for People and for Cells

CONTENTS

2	Spaces for People and for Cells
3	Chondro-Gide® as a Biological Chamber
4-5	“Leaders in Regenerative Biomaterials”
6-7	A 20-Year Success Story
8-9	Prof. Dr. Matthias Steinwachs
10-11	Prof. Dr. Roland P. Jakob
12-13	Dr. Martin Volz
14-15	Prof. Dr. Justus Gille
16-17	Dr. Sven Scheffler
18-19	Prof. Dr. Victor Valderrabano
20-21	Dr. Martin Wiewiorski
22-23	Prof. Dr. Markus Walther
24-25	Prof. Dr. Martinus Richter
26-27	Dr. Andrea Fontana
28-29	Dr. Tomasz Piontek
30-31	Prof. Dr. Elizaveta Kon
32-33	Prof. Dr. Ivan Martin
34	Rebuilding an Injured Knee
35	Building the Future
36	References

Cover Photo

Airspace Tokyo
Architect (facade): Faulders Studio
Architect (building): Studio M
Photo: Faulders Studio

Since the 1980s, Geistlich Pharma has been a leader in the research and production of biomaterials for bone and cartilage regeneration. As a pioneer in regenerative medicine, Geistlich has contributed significantly to the development of less invasive surgical techniques that are now possible. Now patients suffer less pain and we understand how to leverage the body’s own healing processes for enduring results.

The collagen matrix Chondro-Gide® developed by Geistlich Pharma was launched 20 years ago. It exemplifies our innovative strength as a company. To celebrate this anniversary, we have profiled some of the leading surgeons and scientists who have researched and developed the use of Chondro-Gide® for cartilage regeneration in the knee, ankle, and hip. We have paired these

profiles with images of architectural structures, because cells – like humans – need protective habitats. And just as architects create enduring structures, physicians strive for enduring healing and can be considered “architects of regeneration.”

The people featured here are just a few of the many who have made outstanding contributions in the field of modern cartilage regeneration. While the space given here is limited, we have created a microsite to showcase a larger number of surgeons and researchers. Let us know what kind of “architect” you are and send us a video! Interviews with the profiled doctors can also be found here:

www.membran20.com



Chondro-Gide[®] as a Biological Chamber

All living systems, of all sizes — whether human beings or cells — need suitable environments to build successful communities.

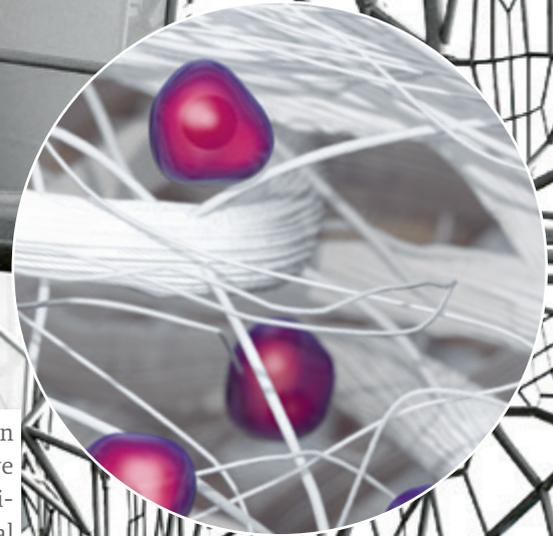
When designing urban spaces, architects are guided by peoples' needs for light, space, communication, and transportation. The development of biomaterials is subject to similar requirements at the micro level. Surfaces, spatial conditions, access, and possibilities for communication in the material determine how successfully cells settle and network.

The design and architecture of materials for regenerative processes must meet the cells' needs. Just as we at Geistlich cultivate relationships with doctors and create opportunities for exchange, we also create environments in which cells can successfully develop and thrive.

Chondro-Gide[®] is an example of Geistlich's pioneering work in regenerative orthopedics: it is a biocompatible

and fully resorbable porcine collagen membrane.¹ It provides a protective shell for the first fragile stages of cartilage repair. The collagen material blends into the body's architecture without irritation and can be readily colonized by cells.^{1,2} The collagen membrane forms a biological chamber, which offers protection from the outside and prevents the loss of cells. Cells can attach themselves to the bottom layer of the chamber and proliferate.^{3,4} Like a building after the scaffolding has been dismantled, the building blocks remain to allow population by new hyaline-like replacement cartilage over time.⁵

The unique technology of Autologous Matrix Induced Chondrogenesis (AMIC[®]) with Chondro-Gide[®] has been clinically proven for more than 10 years.⁶



GEOtube Tower, UAE
Architect: Faulders Studio, USA
Rendering: Faulders Studio

«We are Leaders in Regenerative Biomaterials.»

Chondro-Gide® has been used by Geistlich for 20 years and has established itself internationally as the standard for treatment of cartilage defects. The success of this collagen matrix, in addition to in-house research, development and communication, is also due to a network of researchers and surgeons.

Question: The theme of this brochure celebrating the 20th anniversary of Chondro-Gide® is “healing architecture,” which is somewhat surprising. What do architecture and medicine have in common?

Paul Note: The comparison might seem unlikely. But actually, architects and surgeons share similar goals: both want to create harmonious organisms. Architects want to build houses that last for decades or centuries. Surgeons want an operated knee or an operated hip to serve a patient throughout his life, ideally.

How important are Chondro-Gide® and AMIC® to the Geistlich Pharma portfolio?

Since the 1980s, Geistlich has taken on a pioneering role in the field of regenerative biomaterials. In regenerative dentistry, our company (Geistlich Biomaterials) has been the world market leader for decades.

Chondro-Gide® (Geistlich Pharma) in turn is the standard in Europe for the regeneration of cartilage defects in the knee, hip, and foot. AMIC®, developed by Geistlich, is based on bone marrow stimulation techniques. The resulting „Superclot“ in the defect is covered and protected by the Chondro-Gide®. In addition, the implant also stimulates the growth of new cells that form cartilaginous repair tissue.

“Pioneer” is listed as the first of the company’s 5 core values. Chondro-Gide® is turning 20. Does it still play a pioneering role?

Compared to dentistry, interventions for cartilage defects in medicine are less common. In addition, we are working with leading international surgeons to develop new application technologies besides



Paul Note
CEO
Geistlich Pharma AG

AMIC®. In that sense, Chondro-Gide® is still in start-up mode, so to speak.

“Regeneration Expert” is the company’s second core value. How has Geistlich evolved from a producer of glue and gelatin to the leading manufacturer of products for bone and cartilage replacement?

Geistlich Pharma has focused on the processing of organic matter throughout its history and has more than 160 years of experience in bioderived products. The company itself has also grown organically. In the 1980s, Dr. Peter Geistlich, Chairman of the Board of Geistlich Pharma until his death in 2014, decided to develop

biomaterials for bone and tissue regeneration. In collaboration with international researchers, he pioneered and developed Bio-Oss®, a bone substitute for use in regenerative dentistry. At the same time, the company also launched Orthoss®, a bone replacement material for use in bone defects. The following decade Bio-Gide®, a collagen membrane for dentistry, and Chondro-Gide® were launched.

“Connected” is the company’s third core value. Among other things, Geistlich maintains a scientific network. Which institutions and individuals does this include?

We work with around 100 universities; about 30 in orthopedics. In clinical application and research, our relationships with university hospitals play a central role. We also rely heavily on leading Swiss clinics that specialize in orthopedics, dentistry, and cell biology.

“Family” is the company’s fourth core value. Is Geistlich Pharma still a family business?

Yes, it is. For more than 160 years, the Geistlich family has been committed to sustainable success on its own. This gives us the freedom to think long term and to develop innovative products responsibly. “Family” also means that the company has a team spirit and a family atmosphere, with flat hierarchies and an accessible management team. And finally, we consider our community of researchers and surgeons part of this family.



“Scientific” is your company’s fifth core value.

As experts in bone and tissue regeneration, we see enormous potential in the use of collagen for the future of regenerative medicine. That’s why, at our headquarters in Switzerland, we have brought together a team of biochemists, material scientists and process engineers to focus exclusively on collagen and its potential for therapeutic applications. In our vision for 2030, pharmaceuticals will once again play a major role.

“Since the 1980s, Geistlich has taken on a pioneering role in the field of regenerative biomaterials.”

What else can we expect from Geistlich in terms of biomaterials?

We are making major investments in our development and new products. Being located in Switzerland, maintaining our uncompromising standards remains. We research, develop, and manufacture all our products at our headquarters in Wolhusen.

A 20-Year Success Story

Leading cartilage specialists use AMIC® and have helped to improve techniques and expand application areas over the years.

In the 1980s, Dr. Peter Geistlich, Chairman of the Board of Directors of Geistlich Pharma until his death in 2014, had the

visionary idea of investing in regenerative biomaterials. “To this day, his name stands for the quality of our products and continues to guide the direction of our company.” says Geistlich CEO Paul Note.

Since then Geistlich has been a pioneer in bone and cartilage regeneration, including developing the collagen matrix Chondro-Gide®.

Geistlich has always pursued science-based development in collaboration with universities and clinical practitioners. On this page, you will find portraits of several surgeons and researchers from 1999, when Chondro-Gide® was introduced. Since then, their fields of application and surgical techniques have steadily evolved, as shown in the timeline on this and the next page.



The idea that microfracturing (MFX) alone does not always bring sustainable solutions is in the air. Behrens, Jakob, and Steinwachs outline the first ideas for Chondro-Gide® and AMIC®.

1999

Chondro-Gide® receives the CE mark as a medical device and is first used in Autologous Chondrocyte Implantation (ACI)

1 Prof. Dr. Matthias Steinwachs 2 Prof. Dr. Roland P. Jakob 3 Dr. Martin Volz 4 Prof. Dr. Justus Gille 5 Dr. Sven Scheffler
6 Prof. Dr. Victor Valderrabano 7 Prof. Dr. Markus Walther 8 Prof. Dr. Martinus Richter 9 Prof. Dr. Elizaveta Kon

2019

190 publications on Chondro-Gide®
MEFISTO, an international project under the
EU research program "Horizon 2020"

2016

BIO-CHIP, an international project under the
EU research program "Horizon 2020"

First AMIC® Hip Publication 2012⁹

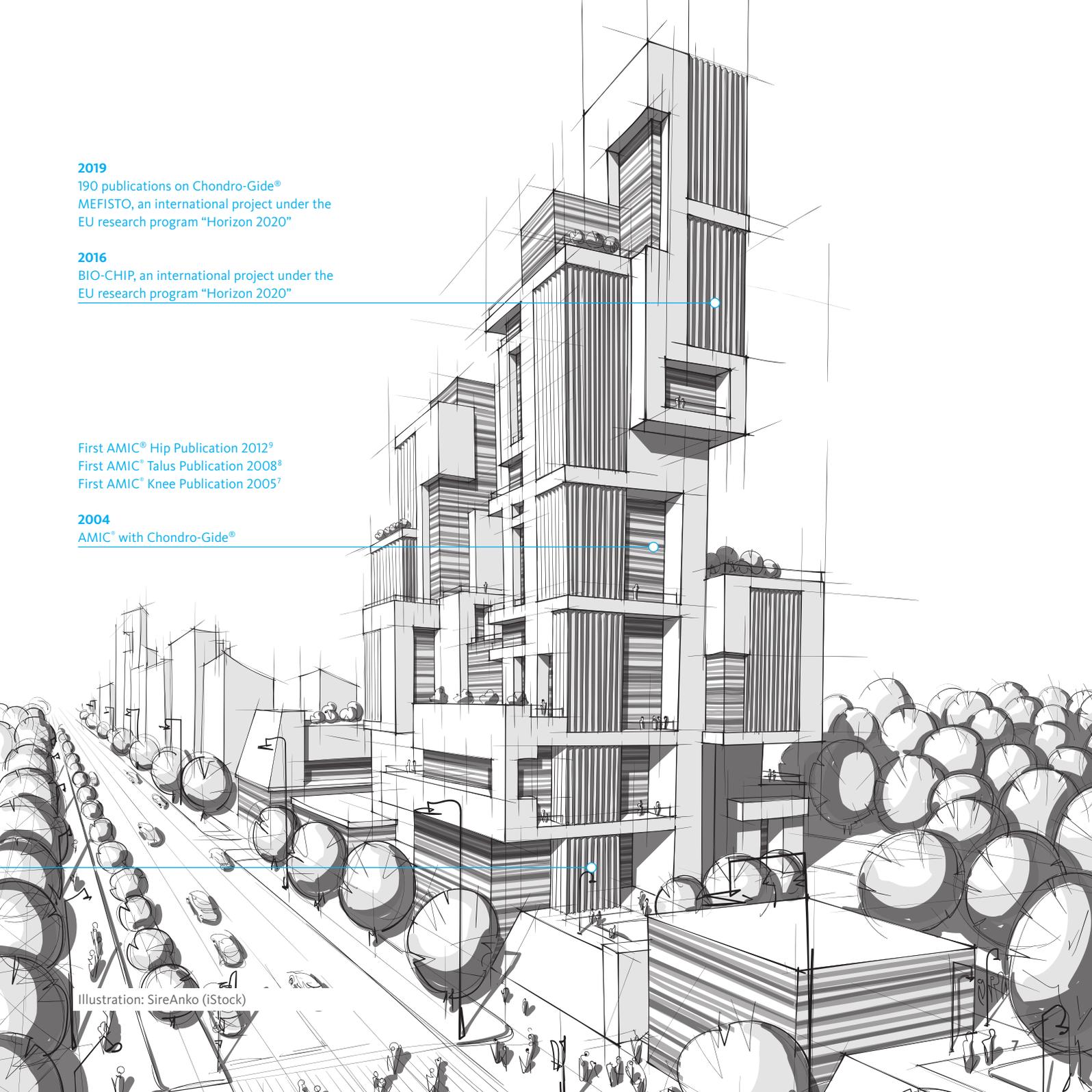
First AMIC® Talus Publication 2008⁸

First AMIC® Knee Publication 2005⁷

2004

AMIC® with Chondro-Gide®

Illustration: SireAnko (iStock)





Prof. Dr. Matthias Steinwachs

Prof. Dr. Matthias Steinwachs has been a specialist in orthopedic surgery and traumatology at SportClinic Zurich in Switzerland since 2014.

A specialist with many years of experience, Prof. Steinwachs pioneered the use of Chondro-Gide® instead of periosteum in cartilage regeneration (ACT) and pioneered the use of collagen-based materials in orthopedics.

Steinwachs is a lecturer in Orthopedics at the University of Freiburg (Switzerland) and Honorary Professor at the Institute of

Sports Medicine of Peking University. He also teaches at the Swiss Federal Institute of Technology in Zurich.

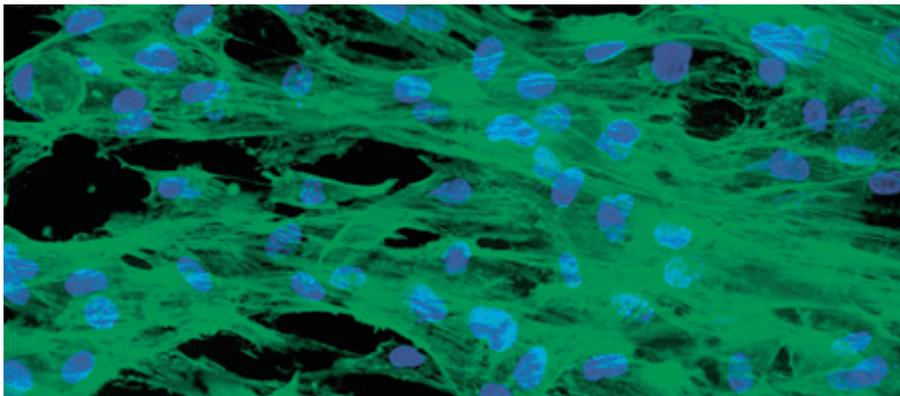
Since 2014, he has been a specialist in orthopedic surgery and traumatology at SportClinic Zurich. With his many years of research and clinical experience, Steinwachs is a leading international expert in regenerative procedures for cartilage damage. He uses all modern methods of cartilage regeneration, particularly, AMIC® Chondro-Gide®, in combination with the body's own healing potential and cells. His goal is to use regenerative techniques to prevent or delay the development of arthritis in the knee as well as knee replacement surgeries.

Steinwachs also focuses on the biological properties of cells that determine the success of a biomaterial and its treatment. As with urban planning, the environment, methods, and needs of the first “settlers” determine the urbanization of the materials and the integration of the new mate-

“I consider AMIC® to be an effective and reliable treatment for cartilage lesions due to its long-term clinical results.”

rial into the whole. Using the Matrix Associated Chondroplasty (MACH) technique¹⁰ he developed, he combines cells and growth factors from bone marrow with Chondro-Gide® to create a localized “biochamber”.

As a member of national and international professional societies and research committees, Steinwachs has received several awards and authored numerous articles in the field of orthopedic surgery.



Mesenchymal stem cells attached to collagen fibers of Chondro-Gide®.

Note: MACH is not approved in all countries.

Architect of Cell-Centered Environments

ICD/ITKE-Research Pavilion 2015–16
Architect: ICD/ITKE University of Stuttgart
Photo: ICD/ITKE University of Stuttgart



Prof. Dr. Roland P. Jakob

Prof. Dr. Roland P. Jakob is Professor Emeritus of the Faculty of Medicine at the University of Bern and former Head of the Clinic for Orthopedic Surgery at the Freiburg Cantonal Hospital in Switzerland.

During his career, Prof. Jakob has provided clear evidence for the sustainable use of Chondro-Gide® in cartilage and larger bone defects in the knee.

A leading Swiss orthopedic surgeon, Jakob completed his training in orthopedic surgery from 1968 to 1975 in Switzerland as a student of Prof. M.E. Müller, and in Finland and Canada as well.

In 1981, he was appointed Associate Professor of Orthopedic Surgery and, in 1988, Professor at the University of Bern, where he also served as deputy chief physician at the Orthopedic Clinic at the Inselspital. From 1995 to 2007, he was the director of the orthopedic department of the Freiburg Cantonal Hospital. He was also a lecturer in anatomy at the University of Freiburg.

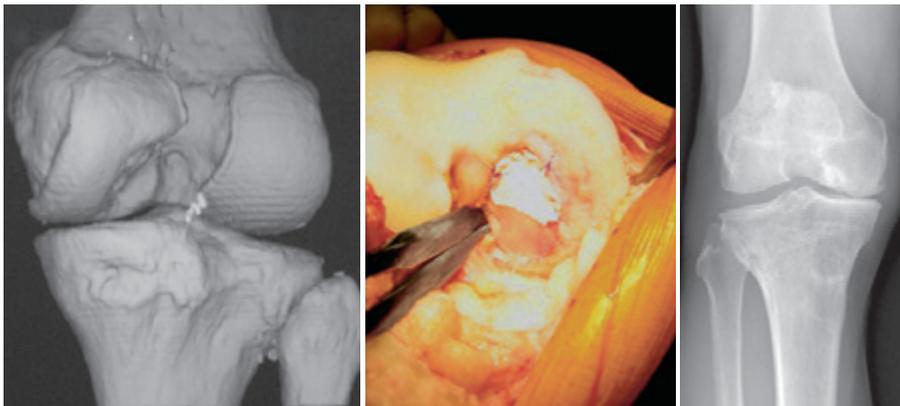
Jakob has dedicated his life's work to a wide range of areas within orthopedics and traumatology. He has also focused on regenerative therapy approaches for joint diseases especially in the knee, by looking holistically at the patient, symptoms and causality, therapy, and exploring areas relevant to biology and pathophysiology. He was a friend and adviser to Dr. Peter Geistlich, and played a significant role in the development of AMIC® Chondro-Gide®.

He has established and consistently promoted the development of new applications of Chondro-Gide® in menis-

“The vast majority of my early AMIC® knee patients with a 10 year follow-up are happy with the results.”

cus regeneration and repair. He expanded the use of AMIC® by combining Chondro-Gide® with Orthoss® to stimulate the differentiation of bone stem cells along both osteogenetic and chondrogenetic pathways to treat large osteochondral defects in the knee and ankle.¹¹

Jakob's work, including his AMIC® Chondro-Gide® studies, has appeared in numerous publications. He has held key positions in Swiss and international orthopedic societies, including founding president of the International Cartilage Repair Society (ICRS) and president of the International Society of Arthroscopy, Knee Surgery and Orthopedic Sports Medicine (ISAKOS). He was also President of the Swiss Orthopedic Society and the Swiss AO.



The 3D reconstruction of the medial femur condyle shows a severe defect of the articular surface. The Chondro-Gide® is cut to size and affixed. The defect is filled with a 1:1 mix of autologous cancellous bone and apatite granules (Orthoss®). Six years later the x-ray shows good bony consolidation and confirms that the joint space has been preserved.



Architect of Holistic Structures

Gardens by the Bay, Singapore

Architect: Wilkinson Eyre

Landscape Architect: Grant Associates

Photo: Takaki Nakajima (Shutterstock)



Dr. Martin Volz

Dr. Martin Volz is an orthopedist, trauma surgeon, and specialist in sports medicine. A competitive athlete, he co-founded the Sportklinik Ravensburg in Germany in 2010.

Dr. Volz's research has provided the crucial evidence that AMIC® Chondro-Gide® delivers better long-term results than MFX alone.

Volz studied at the Universities of Ulm and Pittsburgh and graduated as a specialist orthopedist in 1997. Since 2009, he has also specialized in trauma surgery. He deepened his knowledge through a Fellowship at the University of Pittsburgh

and several internships in the US and at the University of Zurich. After 12 years in private practice at the Heilig-Geist-Hospital in Ravensburg, he founded the Sportklinik Ravensburg in 2010.

A competitive athlete, Volz focuses on sports medicine. He is the team doctor of a hockey club and a football club.

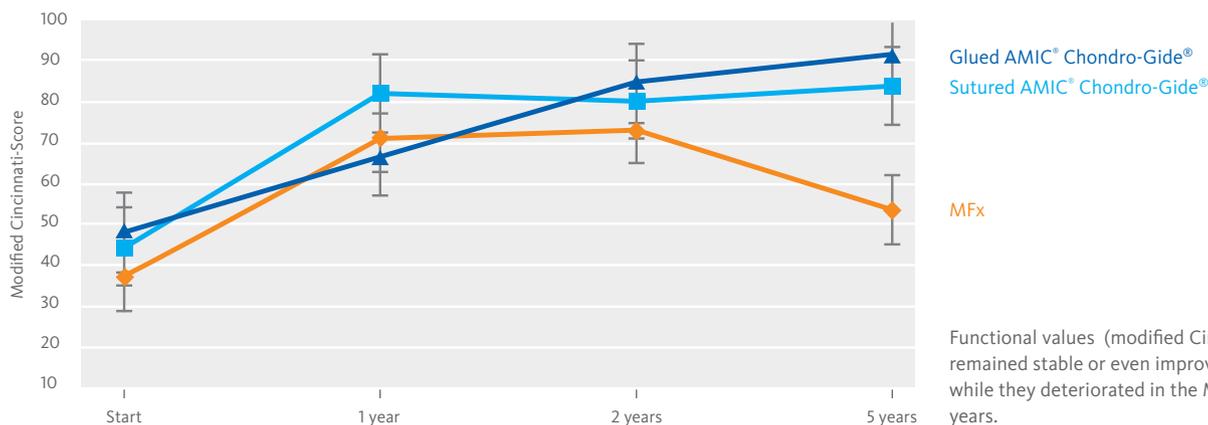
Volz has performed more than 10,000 shoulder and knee surgeries. With Dr. Sven Anders (University of Regensburg), he carried out an important randomized, controlled 3-armed clinical study with 47 patients (27 at the Sportklinik Ravensburg, 20 at the University of Regensburg). After 5 years, the authors compared the results of treating isolated cartilage defects with microfracturing (MFX) alone with treating these types of defects with AMIC® Chondro-Gide® (glued or sutured).¹²

The study showed that Chondro-Gide® glued or sutured produced equally good

“We are happy to have scientific data to prove our success.”

results. Compared to MFX alone, the results of knee function were consistently significantly better with Chondro-Gide®. As in other studies, there was a significant improvement in all treatment groups in the first year, followed by stabilization in the second. Patients who had MFX alone experienced a worsening of pain and functionality after the second year, while patients who had AMIC® Chondro-Gide® continued to improve.

Volz is a member of several professional associations.



Functional values (modified Cincinnati-Scores) remained stable or even improved with AMIC®, while they deteriorated in the MFX group after 2 years.

Architect of Sustainable Structures

Metropol Parasol, Sevilla
Architect: Jürgen Hermann Mayer
Photo: Getty Images



Prof. Dr. Justus Gille

Prof. Dr. Justus Gille is Head of Arthroscopy, Joint Surgery, and Sports Medicine at the Department of Orthopedics and Traumatology at the University Hospital Schleswig-Holstein (UHS) in Germany

As a pioneer in arthroscopic AMIC[®], Prof. Gille has demonstrated the replicability of the technique in studies and shares his knowledge as a professor and colleague in courses and workshops.

Gille studied medicine at the Universities of Hamburg, San Diego, and Cape Town, and trained as a specialist in orthopedics and trauma surgery in Lubeck and Hamburg. Today, he works at the UHS as Senior Physician and Head of Arthroscopy, Joint Surgery, and Sports Medicine.

Gille has published more than 40 papers and has received multiple scientific awards, including the Herbert Lauterbach Prize for outstanding achievement in the field of trauma medicine. The subject of his post-doctoral thesis at the University of Lubeck in 2010 was AMIC[®].

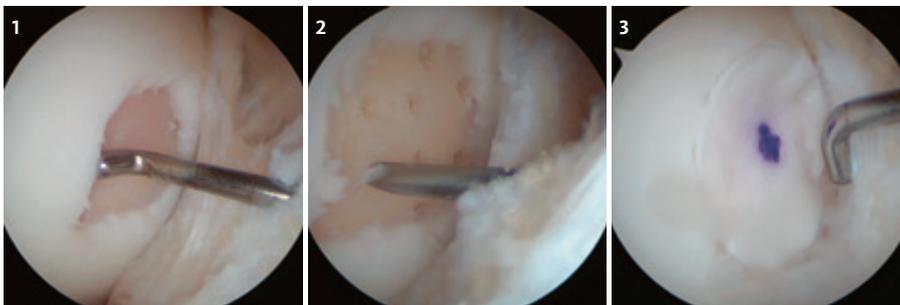
The focus of his scientific work is on the treatment of damaged articular cartilage after sports injuries or accidents at work. Gille investigates the interaction between cells and Chondro-Gide[®] as well as how the membrane behaves in the patient. He constantly improves his technique as a surgeon, and shares his research and experience in numerous workshops with colleagues

In one study, Gille compared AMIC[®] mini-open and arthroscopic AMIC[®] surgical techniques, based on the technique developed by Dr. Tomasz Piontek. The study showed no significant differences between the techniques after 1 and 2 years. In both cases, an improvement of VAS (Visual Analog Score) pain scores was detected, along with a significant improvement in Knee Injury and Osteoarthritis Outcome Score

“Whether arthroscopic or open, AMIC[®] brings enduring good results in both cases.”

(KOOS) and Lysholm functional scores compared to the situation before treatment.¹²

Today, Gille uses a technique that allows the introduction of the Chondro-Gide[®] under flush flow.



- 1 Wet arthroscopic AMIC[®] technique
- 2 Measuring defect after debridement and microdrilling
- 3 Positioning and fixing the Chondro-Gide[®] with fibrin glue. The top of the Chondro-Gide[®] was marked with a sterile pen to ensure proper orientation in the defect.

Architect of Natural Spaces with Minimally Invasive Access

Basel Exhibition Center
Architect: Herzog & de Meuron
Photo: Ververidis Vasilis (Shutterstock)



Dr. Sven Scheffler

Dr. Sven Scheffler practices at the Sporthopaedicum in Berlin. As a researcher, he is involved in experimental studies on cruciate ligament transplants.

In clinical studies, Dr. Scheffler showed that large osteochondral defects can also be successfully treated with AMIC® and cancellous bone graft over the long term.

After studying and practicing medicine in the US, at the University of Pittsburgh, Harvard Medical School, and the Haw-

kins Clinic in Vail, Scheffler completed his specialist training at the Charité Berlin in 2008. Scheffler is a registered doctor at the Sporthopaedicum in Berlin.

Scheffler was involved in a study on the use of AMIC® in the knee. In young, physically active patients, osteochondral defects in the knee can lead to functional disability. For treatment, various 1- or 2-stage therapy methods are used: refixation; osteochondral transfer; and allograft; autologous chondrocyte transplantation (ACT), which is a complicated and costly 2-step process.

Scheffler and his colleagues used AMIC® as a cost-effective alternative to ACT, and combined it with a cancellous bone graft. The study demonstrated that the use of AMIC® Chondro-Gide® resulted in a significant and lasting improvement in knee function and the development of homogeneous cartilage tissue in large osteochondral defects.

“ACT and the 1-step AMIC® deliver comparable results.”

The results remained stable over the medium term and were comparable to the 2-step ACT procedure: in 2/3 of patients, knee function was significantly better 4 years after surgery than before surgery.¹⁴

Scheffler is a member of renowned national and international orthopedic societies.



Results of treatment of osteochondral defects with autologous graft and AMIC®.

Significant improvement in KOOS and IKDC scores after 12 months and further improvement after approximately 4 years.

Picture: Osteochondral defect that can be treated with cancellous plastic + AMIC®.

Table: KOOS and International Knee Documentation Committee (IKDC) score before and after treatment

Score	Pre-OP	12 months Post-OP	49 months Post-OP (mean, 36-61)
KOOS	50.0 (± 18.9)	76.4 (± 17.0)	81.7 (± 13.9)
IKDC subjectively	36.6 (± 20.6)	65.4 (± 21.9)	72.2 (± 18.7)

Architect of Profound Reconstruction

Green Heart, Marina One, Singapore

Architect: ingenhoven architects/HGEsch

Image: ingenhoven architects/HGEsch

© ingenhoven architects/HGEsch



Prof. Dr. Victor Valderrabano

Prof. Dr. Victor Valderrabano is an honorary professor of Orthopedics and Traumatology of the musculoskeletal system at the University of Basel and Chief Physician of the Swiss Ortho Center at the Pain Clinic Basel in Switzerland.

Prof. Valderrabano pioneered AMIC® Chondro-Gide® in the ankle.

Valderrabano received his doctorate in Zurich and trained in Basel, Davos, and Calgary to become a specialist in orthopedic surgery and traumatology of the musculoskeletal system at the Swiss Federal Medical Association (FMH). He is also certified in Sports Medicine and earned a second doctorate in biomechanics while

in Calgary. In 2009, Valderrabano became Professor of Orthopedic Traumatology at the University of Basel and Chief Physician of the Orthopedic University Hospital Basel. Since 2015, he has been the chief physician at the Swiss Ortho Center at the Pain Clinic Basel, which belongs to the private clinic group, Swiss Medical Network.

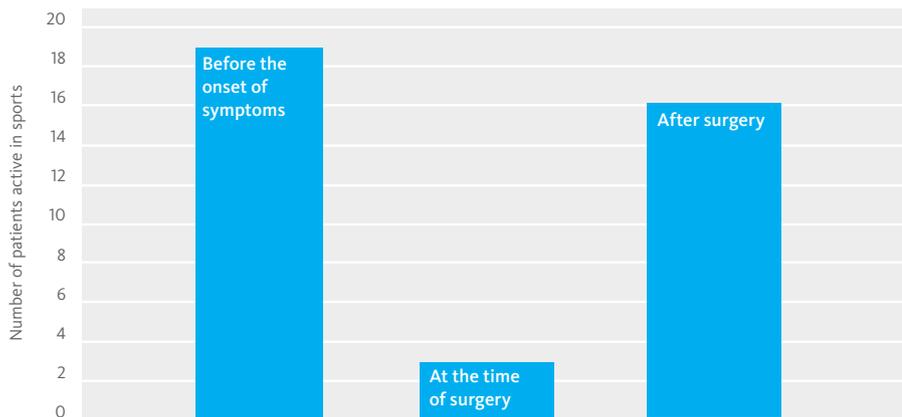
Valderrabano is constantly expanding his range of joint-preserving therapies. With his team, he developed AMIC® in the ankle and published the first clinical studies on this procedure. He has provided significant evidence that AMIC® helps restore the functionality of the ankle. He enables his patients to continue an active lifestyle and with? maximum mobility. Valderrabano has treated a number of well-known athletes.

One of his AMIC® Chondro-Gide® activity studies showed that the American Orthopaedic Foot and Ankle Society (AO-FAS) pain scores improved significantly

“Chondro-Gide® has greatly changed the treatment of cartilage damage in the ankle.”

and patients regained their athletic activity. Follow-up included at least 20 months and 26 patients treated with debridement, autologous grafts, and AMIC® Chondro-Gide®.¹⁵

Valderrabano is the driving force in several organizations. Among other things, he is President of the Swiss Foot and Ankle Society. He has also published numerous scientific articles and books, and received many prizes and awards.



Patients and their sports activity before and after AMIC

Architect of Networks Across Different Dimensions

Kings Cross, London
Architect: John McAslan + Partners
Photo: Getty Images



Dr. Martin Wiewiorski

Dr. Martin Wiewiorski, ankle and foot expert, is Head of Foot Surgery at the Department of Orthopedics and Traumatology of the Cantonal Hospital in Winterthur, Switzerland.

Dr. Wiewiorski has provided clinical evidence for the long-term, replicable performance of AMIC® in the ankle joint.

After completing a medical degree in Munster, Wiewiorski continued his education as a specialist in orthopedic surgery and traumatology of the musculoskeletal

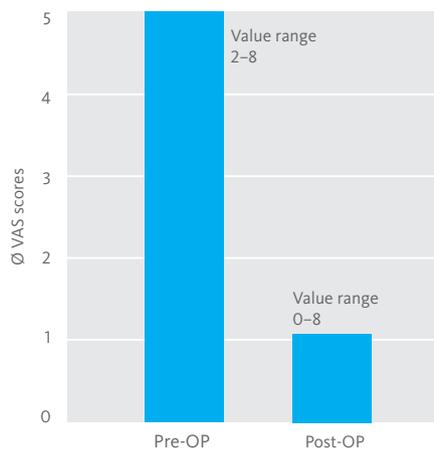
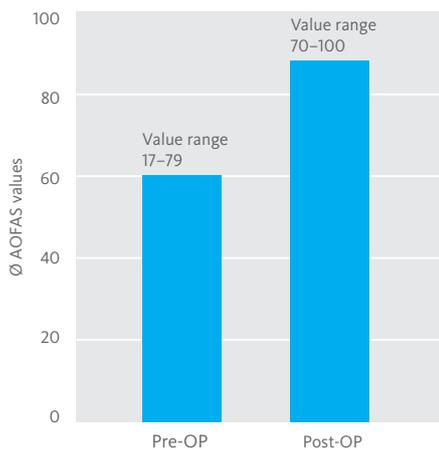
system through clinical and research work in Basel, Bochum, and Boston. He then completed a Master’s Degree in Health Care Administration Management at the University of Kaiserslautern and served as Senior Physician at the Cantonal Hospital of Basel in 2014. Since May 2015, he has been a senior physician at the Clinic for Orthopedics and Traumatology of the Cantonal Hospital in Winterthur.

The foot represents balance, flexibility, and aesthetics, and must carry enormous loads. Each intervention should receive its complex balance and supporting role – a task that requires knowledge and experience. Wiewiorski has investigated the restoration of functionality and cartilage, whether the foot is “only” for running, helping a football player to score a goal, or supporting a ballerina on pointe shoes. In his work, Wiewiorski researches the functionality of the joint and the resumption of sports activities after surgery with AMIC® Chondro-Gide®.

“Chondro-Gide® offers great benefits for both the patient and the surgeon.”

Wiewiorski, Prof. Dr. Victor Valderrabano (University of Basel), and Prof. Dr. Alexej Barg (University of Utah) were awarded the prestigious Klenerman Prize by the British Orthopedic Foot & Ankle Society in 2018 for their research, “Autologous matrix-induced chondrogenesis (AM-IC®)-aided reconstruction of osteochondral lesions of the talus – 5 year follow-up”. The work demonstrated that AMIC® Chondro-Gide® in the talus shows a lasting and stable improvement of foot function and reduction of pain after 5 years.¹⁶

Wiewiorski has been cited in more than 100 publications. He is a member of many professional organizations.



Results of osteochondral lesion (OCL) treatment with debridement, cancellous bone graft, and AMIC® in 17 patients after 5 years.

AOFAS = American Orthopedic Foot & Ankle Society
VAS = Visual Analog Score

P < 0.01

Architect of the Perfect Ankle

Bridge in China
Photo: iStock



Prof. Dr. Markus Walther

Prof. Dr. Markus Walther is chief physician for foot and ankle surgery at the Orthopedic Clinic Munich-Harlaching and professor at the University of Würzburg in Germany.

Prof. Walther is a pioneer of minimally invasive techniques such as the mini-open AMIC® Talus technique, which does not require an access osteotomy and is documented by 5-year data.

Since 2005, Walther has been Medical Director and Senior Physician of the Center for Foot and Ankle Surgery at the Schön Klinik München Harlaching FIFA Medical

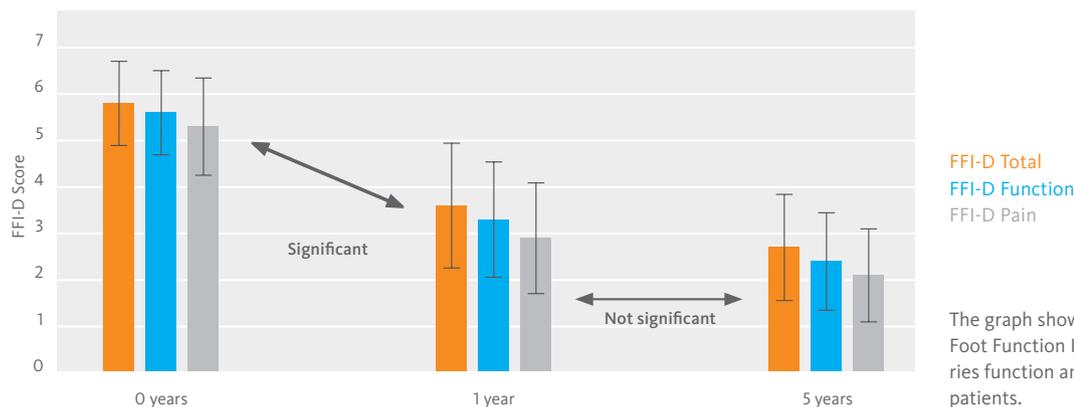
Center of Excellence. At the University of Würzburg, he teaches orthopedics and traumatology of the foot and ankle. He is the club doctor for the Bayern Munich soccer team.

As a member of many orthopedic societies and as former president of the German Society for Foot Surgery (GFFC), Walther has received a number of awards, including the Arthur Vick Prize, the DEGUM Prize, and the Michael Jaeger Research Award from the Society for Orthopedic Trauma Sports Medicine (GOTS).

Walther is the author of numerous publications on sports medicine, foot orthopedics, and biomechanics. He was a longtime member of the GOTS Board, an International Fellow of the American Society of Foot and Ankle Surgery, and a member of numerous professional associations. His current research interests include biomechanics, sports traumatology, and reconstructive surgery of complex foot and ankle disorders, including regenerative therapy with AMIC®.

“Chondro-Gide® has had a decisive influence on our treatment strategies.”

In a study of a group of patients treated with AMIC® and followed over 5 years, the largest and statistically significant clinical improvements were seen after 1 year. By the fifth year, the levels continued to improve, but not statistically significantly. Patients returned to their sports activity, although not all reached their original performance level again.¹⁷



Architect of Sustainability



Heydar Aliyev Center, Baku
Architect: Zaha Hadid
Photo: Elnur Amikishiyev (Canva)



Prof. Dr. Martinus Richter

Prof. Dr. Martinus Richter is Chief Physician for Foot and Ankle Surgery Hospital Rummelsberg and Sana Clinic Nuremberg as well as a Professor at the Hannover Medical School in Germany.

As a specialist in foot surgery, Prof. Richter tirelessly researches methods to advance the regeneration and healing processes. He is a pioneer of the matrix-associated stem cell transplantation (MAST) method in the ankle and metatarsophalangeal joint.

After studying medicine in Freiburg (Germany) and completing a second degree as

a health economist, Richter graduated in 2002. In 2006, he was appointed as adjunct professor at the Hannover Medical School (MHH), where he was previously an assistant and senior physician in the trauma surgery clinic. From 2006, Richter worked as chief physician at the Klinikum Coburg and the Hennberg-Kliniken Hildburghausen. Since 2011, he has been the chief physician of the Department of Foot and Ankle Surgery Hospital Rummelsberg and Sana Clinic Nuremberg.

One area of focus in Richter's research has been matrix-associated stem cell transplantation (MAST) for cartilage replacement in the foot and ankle. MAST is a modification of AMIC® Chondro-Gide®. With MAST, cells that promote regeneration are used from the iliac crest in the talus and, more recently, in the metatarsophalangeal joint, for which no regenerative treatment procedure existed previously. By covering the filled defect with Chondro-Gide®, a biological chamber is created, in which new cartilage replacement tissue can form. Five-year

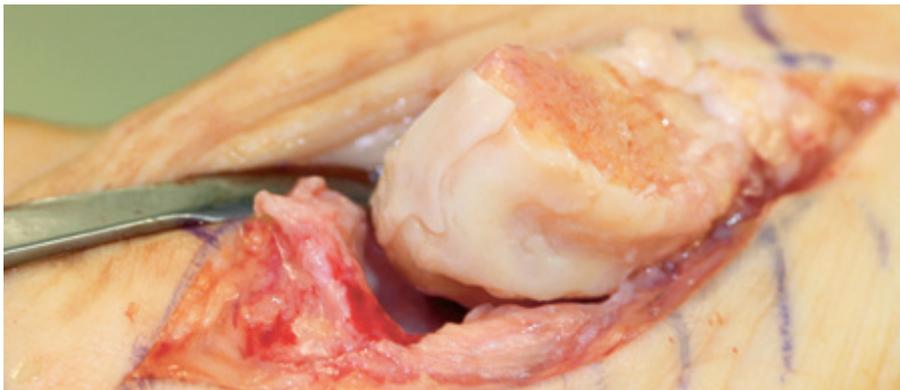
“I have been using Chondro-Gide® for 10 years for cartilage defects in various joints of the foot.”

results from a study of talar-controlled MAST that covered > 100 patients showed sustained good results.¹⁸

Richter has also developed implants for the foot and ankle. His success as a researcher and surgeon is due to his love of precision and speed, coupled with a desire to restore the functionality and aesthetics of the foot.

He is involved in national and international professional societies and has led several scientific congresses. In addition, his work has been cited in numerous publications and he has received many awards and accolades.

Note: MAST is not approved in all countries.



MAST in the cartilaginous defect of the metatarsophalangeal joint

The collagen matrix is cut to fit the defect. Stem cells are harvested from the iliac crest and placed on the Chondro-Gide® prior to implantation.¹⁹

Architect of Orchestrated Urbanization



Elbphilharmonie, Hamburg
Architect: Herzog & de Meuron
Photo: Kai Pilger (Pexels)



Dr. Andrea Fontana

Dr. Andrea Fontana has held leading positions in Italian clinics in Milan and Como, most recently, at the Ortopedica e Fisiatrice Clinic in Lanzo d'Intelvi.

An internationally recognized specialist, Dr. Fontana pioneered the use of AMIC® Chondro-Gide® in the hip and has helped many patients enjoy an improved quality of life.

Fontana studied medicine at the University of Palermo and graduated in 1991 as a specialist in orthopedics and traumatology from the University of Milan. He was a clinical research fellow in the hip and

knee department of the BUPA Cambridge Lea Hospital and at the Addenbrookes Hospital of the University of Cambridge in 1995.

Since 2001, Fontana has been chief physician at the Policlinico di Monza and at the Casa di Cura Santa Rita in Milan since 2006. He later headed the department of arthroscopic and regenerative hip surgery at COF Lanzo Hospital in Lanzo d'Intelvi. He is also a consultant at the Orthopedic Institute of the University of Bologna and the Orthopedic Clinic of the University of Turin.

With his pioneering work on the arthroscopic AMIC® Chondro-Gide® in the hip technique, Fontana has made it possible to work with a biomaterial even in this difficult-to-access area, and has achieved better results than by using MFx alone.

A study of 50 patients treated with MFx alone and 59 patients in the AMIC® group found that after treatment with MFx

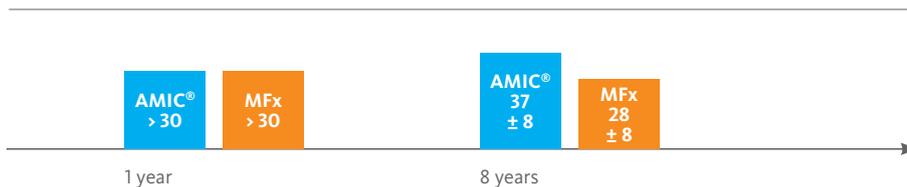
“Thanks to the development of biotechnology, severe cartilage damage in the hip can be treated.”

alone, worsening occurred after only 2 years. Over a period of 5, 7, and 8 years, there was a clear advantage with AMIC® Chondro-Gide®: 22% of the patients in the MFx group needed a total hip replacement (TP) during this time. In contrast, none of the AMIC® Chondro-Gide® treated patients needed a prosthesis. With AMIC® Chondro-Gide®, patients gained joint function and valuable time, without invasive intervention.²⁰

In addition to his medical work, Fontana is a member of multiple international professional societies and author of numerous publications.



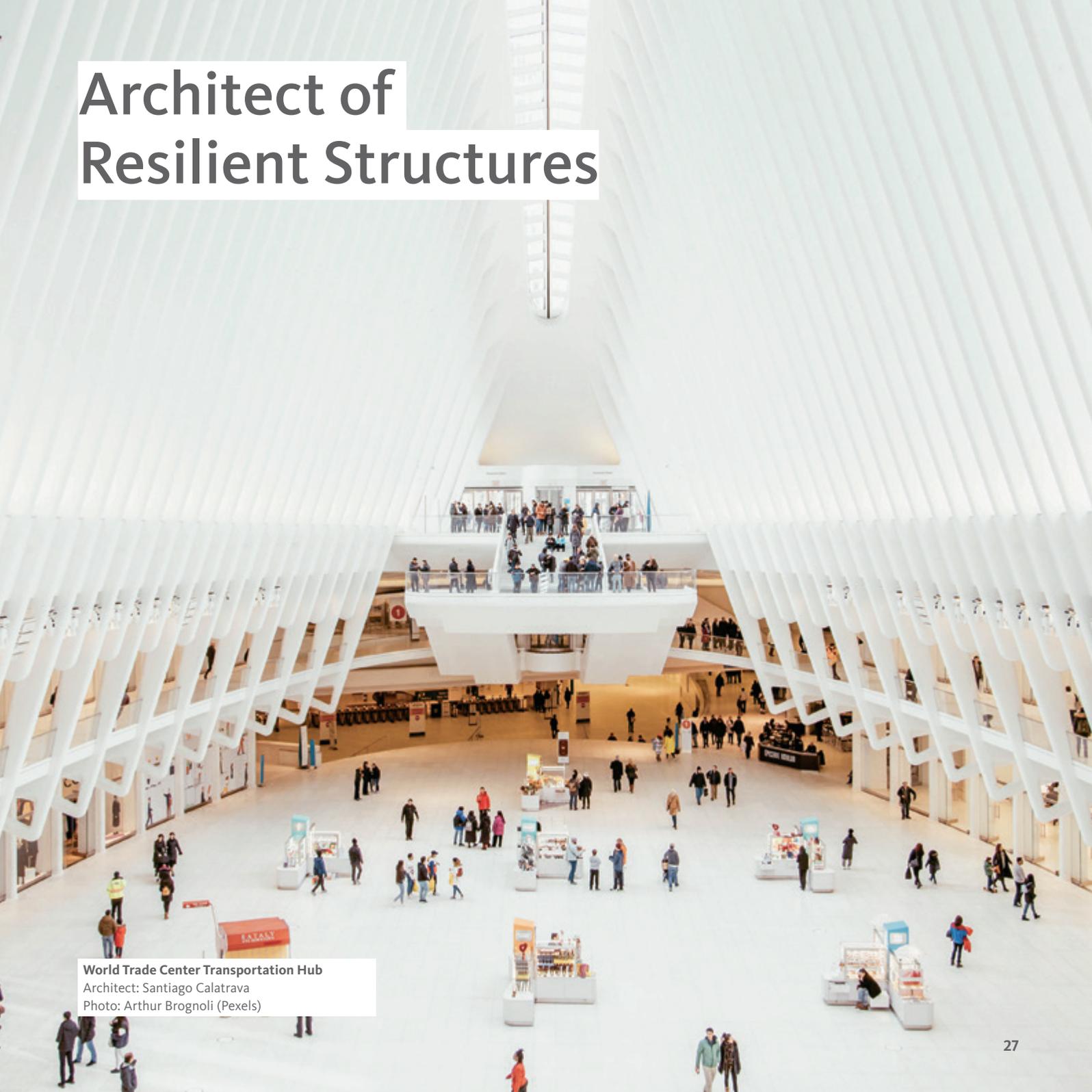
11 patients of the MFx group had to be revised with a total hip prosthesis.



Δ mHHS (modified Harris Hip Score), difference to baseline. Starting value: AMIC® and MFx Ø44.5 mHHS

Results from a study comparing the results of MFx alone with AMIC® Chondro-Gide®.²⁰

Architect of Resilient Structures



World Trade Center Transportation Hub
Architect: Santiago Calatrava
Photo: Arthur Brognoli (Pexels)



Dr. Tomasz Piontek

Dr. Tomasz Piontek, Orthopedist, Traumatologist and Sports Medicine, works at the Rehasport Clinic Poznan and at the Sports Medicine Laboratory of the University of Poznan in Poland.

Dr. Piontek has pioneered the development of surgical techniques for the regeneration of cartilage and the healing of meniscal damage that are based on AMIC® and Chondro-Gide®. His approach to treatment is holistic.

Piontek graduated from the Medical Academy Poznan and specialized in orthopedics and traumatology. Since 2006,

he has worked as a doctor in the Rehasport Clinic in Poznan. The Rehasport Clinic is a private orthopedic and rehabilitation clinic that has been recognized by FIFA as a center of excellence since 2014.

Previously, Piontek worked in the Department of Pediatric Orthopedics in Poznan and supervised 2 football clubs. Piontek completed internships in Zurich, Nottingham, and Pittsburgh. He is an international trainer for arthroscopic surgery in the knee and hip.

In the pursuit of successful treatment and rehabilitation, Piontek takes a holistic approach. He works closely with physiotherapists, among other specialists. As a surgeon and researcher, he mainly deals with sports medicine and has pioneered 2 techniques, both of which are based on the use of Chondro-Gide®: arthroscopic AMIC® and the Meniscus Wrapping Technique.

For arthroscopic AMIC®, the membrane is cut into discs of the same size, which are then arranged to cover the defect. The

“AMIC® has had a lasting positive effect on my practice and my knee.”

Meniscus Wrapping Technique, which is based on the concept of Roland Jakob, should help to prevent a meniscectomy, which can have serious effects on a patient’s quality of life.

Piontek was determined to find a less invasive solution and, through his research, to develop a technique to save the meniscus. He wraps the damaged meniscus with Chondro-Gide® and then injects bone marrow stem cells into the temporary shelter. The Chondro-Gide® matrix contributes to the protection of the repaired tear and creates an „incubator“ in which growth factors and cells can act. Piontek calls the procedure “an arthroscopic collagen matrix-based technique for meniscal repair (AMMR).”



Lysholm Score

IKDC Score subjective (International Knee Documentation Committee)

Results from 14 patients treated with AMMR who did not have comorbidities. The chart shows a significant improvement in the values after 2 years, which remain constant even after 5 years. In total 250 patients were treated with AMMR.²¹

Architect of Temporary Shelters

The Shed, New York

Architects: Diller Scofidio + Renfro and
Rockwell Group
Photo: Ajay Suresh, CC BY 2.0



Prof. Dr. Elizaveta Kon

Prof. Dr. Elizaveta Kon is a professor at Humanitas University and an orthopedic surgeon at Humanitas Research Clinic in Milan.

As an experienced surgeon, Prof. Kon supports and explores the use of various biomaterials in reconstructive surgery. She is one of the initiators of the European research project Meniscal Functionalized Scaffold to Prevent Knee Osteoarthritis Onset after Meniscectomy (MEFISTO).

Kon studied medicine at the University of Bologna, where she also trained as a specialist in orthopedics and traumatology. Until 2017, she was Director of the Laboratory of Nano-Biotechnology and Orthopedics at the Rizzoli Institute of Orthopedics and an Assistant Professor at the University of Bologna. Currently, she is an Associate Professor at the Humanitas University in Milan and an orthopedic surgeon at the Center for Functional and Biological Reconstruction of the Knee at the Humanitas Research Clinic

Kon has been the coordinator of numerous research projects and clinical studies on the application of biomaterials in orthopedics. Now, together with a number of partners, she has initiated the EU-funded Horizon 2020 research project, MEFISTO.

The goal of MEFISTO is to find solutions to a significant medical problem: Meniscal damage can often be treated only by partial or complete removal of the menis-

“MEFISTO develops biomaterials and implants for the joint-preserving meniscus treatment.”

cus. This can lead to knee osteoarthritis in the longer term. As part of MEFISTO, new materials and treatment concepts are now being developed that will enable sustainable joint-preserving therapy. Geistlich Pharma and its German subsidiary Geistlich Biomaterials are heavily involved in the project.

Kon is a member of various specialist societies as well as editors of specialist journals. She has written more than 180 widely acclaimed scientific articles and has received a number of awards and distinctions.

MEFISTO

For more details on the MEFISTO project and all participating partners, visit www.mefisto-project.eu.

This project is funded under the EU research and innovation program, “Horizon 2020” under Grant Agreement No 814444 (MEFISTO).

Architect of a Regenerative Future

Airspace Tokyo

Architect (facade): Faulders Studio, USA

Architect (building): Studio M, Japan

Foto: Faulders Studio



Prof. Dr. Ivan Martin

Prof. Dr. Ivan Martin is a Professor of Tissue Engineering and head of a research group at the Department of Clinical Research at the University of Basel in Switzerland.

Prof. Martin is an internationally recognized specialist in the production of autologous cell-based cell transplants (“from the nose to the knee”) and porous 3D scaffolds for the repair of cartilage and bone tissue.

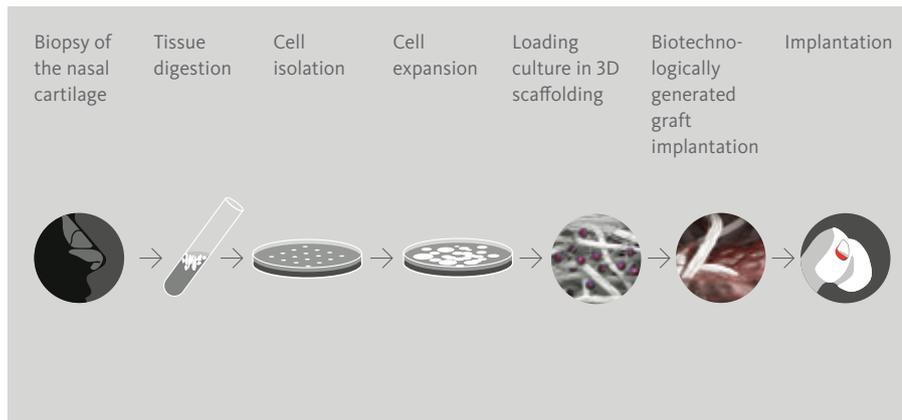
Martin studied biomedical engineering at the University of Genoa, where he earned his doctorate in 1996. He then became a postdoctoral fellow at Harvard-MIT. He joined the Department of Biomedicine at the University of Basel in 1999 as head of the Tissue Engineering Research Group. In 2007, he was appointed Professor of Tissue Engineering. His research group is dedicated to the development of scientific foundations for translational strategies in regenerative medicine.

The method developed by Martin and his team is based on the idea of using cartilage cells from the nose to grow new cartilage tissue and insert it in the knee.²² The cells are transferred to the bilayer Chondro-Gide®, a structure that has a high molecular weight optimally suited for this cell culture approach. An EU-funded project called BIO-CHIP, with partners from Germany, Italy, Croatia, and Switzerland, is researching major innovations in

“We have found that the Chondro-Gide® is very well suited for cell seeding.”

the treatment of traumatic cartilage lesions in the knee. The project focuses on the use of autologous nasal chondrocytes as a source of cells, and the use of a tissue transplant (tissue therapy) as opposed to a cell transplant (cell therapy).

From 2004 to 2009, Martin was the first chair of the European Section of the Tissue Engineering Regenerative Medicine International Society. He is editorial member of 5 journals and author of more than 200 articles in journals and an inventor with more than 10 patent applications. He is co-founder and board member of a spin-off company for the commercialization of tissue culture bioreactors (Cellec Biotek AG).



Process of the BIO-CHIP procedure
www.biochip-h2020.eu



Architect of Bustling Structures

One Central Park Building, Sydney

Architect: Jean Nouvel and PTW Architects

Photo: Olga Kashubin (Shutterstock)

Rebuilding an Injured Knee

In the course of operating on Hanna's knee, Dr. Justus Gille discovered cartilage damage in her kneecap. With AMIC®, he was able to treat it immediately; a second intervention was not necessary.

Hanna is an athletic young woman. In 2015, she fell and injured her knee. Gille, a pioneer of the arthroscopic AMIC®, operated on her. "During the operation, we discovered cartilage damage in the area of the kneecap," explains Gille. "We treated this with the AMIC® procedure." AMIC® is scientifically well-founded and "shows reliable results even in the long-term," he says. "In addition, AMIC® can be used immediately during the operation, which saves the patient from needing a second intervention."

Hanna did not quite understand what exactly the doctors would do to her knee. "But I wanted it to get better soon," says Hanna. "And I wanted it not

"Right after surgery, I could not bend my leg. Now I don't feel any restrictions."

to hurt anymore." The first few weeks and months were difficult: Hanna was first hospitalized at the clinic. After that, it was weeks before she could walk again, and then only with crutches. This period was followed by intensive physiotherapy treatments.

About 1 year after surgery, Hanna started practicing yoga. "I wanted to find another sport besides riding," she says. "Dancing, handball, and soccer were out of the question, they were too dangerous for me."

Yoga proved to be a good choice. She says she enjoys it, and it gives her strength and balance. Now, 4 years later, her injury barely affects her. "Of course, sometimes I still feel it," says Hanna. "But I can go through everyday life as before, with no more restrictions."

Hanna was operated on in 2015 after a knee injury by Dr. Justus Gille. Today, she no longer feels any restrictions in her movements.



Building the Future

Geistlich has pioneered the development of biomaterials, especially for bone and cartilage regeneration. The 160-year history of the company is marked by a pioneering spirit that will also determine the future of the company.

Our goal is to help patients achieve a better quality of life through new biomaterials and surgical techniques. At Geistlich, “innovation” isn’t just a buzzword. It means we are committed to basic research, and that developing new applications for our existing core competencies (e.g., collagen expertise) and developing products to meet the needs of our customers are paramount.

Geistlich is a sustainable and responsible enterprise. With its highly qualified scientists and developers, our R&D team is exceptionally large compared to our total number of employees. We also continuously invest in state-of-the-art technology and equipment and provide our employees with ongoing opportuni-

ties for further education and training. In addition to our own R&D efforts, collaboration with surgeons and researchers and exchanges with universities are crucial. We are inspired by the results and interest demonstrated by our external partners. In clinical practice and research, we not only apply biomaterials in our core areas of competency, we also explore new applications.

Our close relationships with researchers and surgeons have existed since the 1980s, when we launched our first biomaterials products. We collect evidence for the effectiveness and safety of our products, based on scientific data. Sharing knowledge is a central concern: Geistlich organizes numerous practical workshops and lectures at congresses and in cooperation with universities.

We also support research in the field of regeneration through several foundations we have established. Our recently established ON Foundation (also known as the Orthoregeneration Network) is an independent international foundation in the field of orthopedic tissue regeneration driving the development and understanding of new treatment strategies for the well-being of the

patient. The foundation awards prizes in the growing field of regenerative orthopedics.

A concrete example of our commitment to science is our deep involvement in the European research project MEFISTO. As part of MEFISTO, we are working with international partners from science and research to develop new solutions that will provide an improved quality of life for patients with meniscal damage.



Let us know what kind
of “architect” you are and
send us a video!

More information about our
distribution partners:
www.geistlich-surgery.com

Headquarters Switzerland
Geistlich Pharma AG
Business Unit Surgery
Bahnhofstrasse 40
6110 Wolhusen, Schweiz
Phone. +41 41 492 55 55
Fax +41 41 492 67 35
www.geistlich-surgery.com

Germany
Geistlich Biomaterials
Vertriebsgesellschaft mbH
Schneidweg 5
76534 Baden-Baden, Germany
Phone +49 72 23 96 24 0
Fax +49 72 23 96 24 10
surgery@geistlich.de
www.geistlich.de

Chondro-Gide® Turns 20

Architects of Regeneration

References

- 1 Geistlich Pharma AG data on file (Bench test)
- 2 GILLE, J., et al., Cartilage OnlineFirst, January 7, 2010, doi:10.1177/1947603509358721 (Pre-clinical study)
- 3 GOMOLL, A.H., J Bone Joint Surg Am. 2010, 92:2470-90 (Clinical study)
- 4 MUMME, M., Lancet, 2016, 388 (10055) 1985–1994. (Clinical study)
- 5 WIEWIORSKI, M., et al., 2013, Clinical Radiology, Vol. 68, no. 10. p. 1031–1038. DOI 10.1016/j.crad.2013.04.016. Elsevier BV (Clinical Study)
- 6 KAISER, N., et al., Swiss Med Wkly, 2015, 145 (Suppl 210), 43S. (Clinical study)
- 7 BEHRENS, P., Arthroscopie, 2005;18:193–197 (Clinical study)
- 8 VALDERRABANO, V., et al., Orthopädie, 2008, Vol. 4, pp 34–36, (Clinical study)
- 9 FONTANA, A., Arthrosc Tech., 2012, Apr 21;1(1):e63–8 (Clinical Study)
- 10 STEINWACHS, M.R., et al., Arthroscopy Techniques, 2014, (3) 2, pp e279–e282 (Clinical study)
- 11 KUSANO, T., et al., Knee Surg Sports Traumatol Arthrosc, 2012, 20:2109–2115 DOI 10.1007/s00167-011-1840-2 (Clinical study)
- 12 VOLZ, M., et al., Int Orthop, Apr 2017, 41(4), 797–804. (Clinical study)
- 13 SCHAGEMANN, J., et al., Arch Orthop Trauma Surg, Jan 22 2018. (Clinical study)
- 14 HOBURG, A., et al., Arch Orthop Trauma Surg, May 15 2018. <https://doi.org/10.1007/s00402-018-2944-7> (Clinical study)
- 15 VALDERRABANO, V., et al., The American Journal of Sports Medicine. 2013. Vol. 41, no. 3, p. 519-527. DOI 10.1177/0363546513476671. SAGE Publications (Clinical Study)
- 16 WIEWIORSKI, M., et al., The American Journal of Sports Medicine. 2016. Vol. 44, no. 10, p. 2651–2658. DOI 10.1177/0363546516659643. SAGE Publications (Clinical Study)
- 17 GOTTSCHALK, O., et al., The Journal of Foot and Ankle Surgery, 2017, Vol. 56, no. 5, p. 930–936. DOI 10.1053/j.jfas.2017.05.002. Elsevier BV (Clinical Study)
- 18 RICHTER, M., et al., Foot and Ankle Surgery. 2017, Vol. 23, no. 4, p. 236–242. DOI 10.1016/j.fas.2016.05.320. Elsevier BV (Clinical Study)
- 19 RICHTER, M., et al., Foot Ankle Surg. 2017 Sep;23(3):195–200. doi: 10.1016/j.fas.2016.05.318. Epub 2016 May 27. (Clinical study)
- 20 DE GIROLAMO, L., Arthroscopy. 2018 Nov;34(11):3012–3023. doi: 10.1016/j.arthro.2018.05.035. Epub 2018 Sep 25. (Clinical study)
- 21 PIONTEK, T., et al., Cartilage, 2016 Apr;7(2):123–39. doi: 10.1177/1947603515608988. (Clinical study)
- 22 MUMME, M., Lancet, 2016, 388 (10055) 1985–1994. (Clinical study)