CONNECT

Polymer plaster for internal wound sealing

Background

Empa (Swiss Federal Laboratories for Materials Testing and Research) is an interdisciplinary research institute of the ETH Domain for materials science and technology development that has been in existence since 1880. Empa‘s focus is on the development of modern, marketable innovations and efficient technology transfer for industry and society. As a spin-off of ETH Zurich, Alexandre Anthis founded the biomed start-up Veltist, which pursues the goal of optimising surgery with an innovative suture support patch and thus ensuring optimal wound closure and improved healing. Researching the fundamentals of the sealing technology, A. Anthis worked together with Prof. Dr. Inge Herrmann‘s team in the Particles-Biology Interactions Laboratory at Empa in St. Gallen and the Nanoparticle Systems Engineering Laboratory at ETH Zurich.

Hydrogel against leakage after abdominal surgery

Intestinal perforations or intestinal obstructions are acute emergency situations that must be immediately treated and repaired by surgeons. However, surgical interventions on the intestine and the adjacent tissue of the alimentary canal are associated with risks. The primary challenge is to ensure that the contents of the gastrointestinal tract do not enter the interior of the abdominal cavity under any circumstances, so that bacteria-rich material can lead to serious infections. However, conventional surgical instruments such as needle and thread do not offer a sufficient solution for such procedures as joining two pieces of intestine.

Every year, around 14 million people worldwide undergo abdominal surgery. These can be of various origins, but inevitably involve stitching or stapling tissue together. In the process, life-threatening surgical leaks occur in about 10 per cent of affected patients because body fluids leak through the sutures and cause bacterial infections in the body that can develop undetected into sepsis.

For some time now, the development of specific plasters has therefore also been focused on sealing the sutures of the joined pieces of intestine in a stable and sustainable way to prevent leakage. The suture must be able to withstand both high mechanical stress and aggressive digestive juices. In the past, however, the first plasters used to seal internal wounds often had poor tolerance or caused poisoning. Modern versions are now made of biodegradable proteins, which fix the existing problems but bring others with them. Although protein patches speed up the healing process, there is a lack of adhesion and durability, as they dissolve quickly on contact with digestive juices and thus do not guarantee a seal.

New research approaches are now pursuing the development of a material that reliably seals intestinal injuries and surgical wounds inside. A synthetic composite material that consists of four acrylic substances working in perfect synergy (acrylic acid, acrylic acid methyl ester, acrylamide and N,N'-methylenebisacrylamide) and forms a chemically stable hydrogel is promising. In addition, the hydrogel patch actively bonds to the tissue, preventing fluid from passing through and ensuring stability against digestive juices. In addition, the fusion of the acrylic components also enables the formation of networks as well as reliable bonding to mucous membranes.

According to the developers, based on laboratory experiments, the adhesion of the hydrogel plaster is up to ten times higher than conventional adhesive materials and can withstand five times the maximum pressure load of the intestine. The rubber-like composite material reacts selectively with digestive juices that could leak out of the intestinal wound, swells in the process and thus closes all the more tightly. The use of the hydrogel solution is expected to shorten hospital stays and reduce healthcare costs in the future.

The researchers are certain that hydrogel-based wound adhesives represent a promising approach for the future to seal sutures in a way that is both mechanically and chemically robust, thus avoiding intestinal leakage. This groundbreaking innovation has already been patented by researchers at Empa around Alexandre Anthis in Switzerland. He was also awarded the „ETH Pioneer Fellowships“ research prize by the Empa Research Commission in Dübendorf for his work. Now the researchers are in the process of founding a start-up that will bring the innovative material to market maturity.

Are you interested in innovative solutions in the field of surgery? Then you should follow Empa‘s further proceedings regarding the suture support patch. We have already listed suitable contacts for you below.

INDUSTRY EXPERT	JOB POSITION	FIELD OF EXPERTISE
Dr. Alexandre Anthis	CEo at Veltist	Smart Materials
Prof. Dr. Inge Hermann	Research Group Leader at Swiss Federal Laboratories for Materials Science & Technology	Smart Materials
Subas Scheibler	Physicist at Veltist	Smart Materials / medical physics