RESEARCH NEWS

Innovative implants

New Stent With The Potential To Lower Thrombosis Risk

Stents are used to remove narrowings (stenosis) in blood vessels, stabilize the vessels and thus prevent heart attacks or strokes. However, the implantation process damages the inner wall of blood vessel, and in addition a foreign body material is inserted into the blood vessel wall. Both factors can contribute to restenosis of the affected vessel. Researchers at the Fraunhofer Institute for Applied Polymer Research IAP at Potsdam Science Park aim to address these issues with specially coated, biocompatible, degradable stents. The team won recognition for developing a prototype as part of the senetics Innovation Award 2025.

Around half a million stents are implanted in Germany every year to treat narrowing of the blood vessels, a consequence of atherosclerosis. However conventional models made of metal or polymers injure the endothelium, the protective innermost cell layer of the blood vessels, when they are inserted. This cell layer takes a long time to regenerate, and if it is damaged, there is also an elevated risk of thrombosis. To prevent blood clotting and thus thrombosis at the stent site, patients must take high doses of anticoagulant medications — often for the rest of their lives.

To address these issues, a team from the Life Science and Bioprocesses division at Fraunhofer IAP comprised of Dr. Anne Krüger-Genge, Dr. Jörg Bohrisch and Prof. Dr. Joachim Storsberg teamed up with researchers from Brandenburg University of Technology Cottbus-Senftenberg (BTU) to develop an innovative, optimized stent. The INNOSTENT project is funded by the German Federal Ministry of Research, Technology and Space (BMFTR).

Coating lowers the risk of thrombosis

»So far, there has been no material in clinical practice that keeps blood cells from accumulating as a clot at the stent site. That's where we come in«, explains Prof. Storsberg, who is specialist in medical implant research. »We use the natural anti-thrombogenic properties of a healthy endothelial layer. The stent's special interior coating promotes a fast endothelialisation which helps to reduce the risk of thrombosis«, he says. The patented coating from Fraunhofer IAP contains growth-promoting proteins that specifically target the endothelial cells, resulting in faster formation of an intact endothelial cell layer. The researchers expect this to significantly lower the risk of thrombosis following stent implantation. Ideally, this will mean that patients can reduce their use of blood thinners.

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Degradable flexible stents

Once the stent is covered by a protective endothelial cell layer, the risk for thrombosis is much lower. Blood vessels are not rigid structures. They can contract and expand to regulate blood circulation in organs and tissues. This phenomenon, known as vasomotor activity, is permanently impaired by factors such as a rigid stent, that can in turn disrupt the circulation. »Our stent consists of a flexible polymer material, so it barely impairs vasomotor activity after degradation at all«, says Dr. Krüger-Genge, a human biologist. »Another special feature is that the material gradually desintegrates inside the body, allowing the blood vessel to heal completely and restore the original flexibility. Conventional implants, by contrast, stay in place permanently as rigid supports, so they can limit the vessel's motility«, she explains.

3D shapes made from biodegradable materials

The material and its shape have stringent requirements to meet. »While the stent is supposed to not only degrade inside the body but also has to be as flexible as possible, it also has to ensure the necessary pressure stability to support the vessel at the same time«, explains Dr. Bohrisch, a materials scientist. »Innovative production technology is crucial for this. We were able to realize a promising 3D structure through a combination of material development, an adjusted injection molding method and structuring using short-pulse UV lasers.«

An award-winning innovation

The first prototypes of the innovative stent have already been created. Other in vitro studies are also under way in the lab. Tests of hemocompatibility are being performed at BTU. The team was recognized for achieving the innovation level in the senetics Innovation Award 2025, presented at the Kooperationskongress Medizintechnik event focusing on collaboration in medical engineering and technology.

Fig. 1 Due to its unique composition and coating, this innovative stent is expected to further lower the risk of thrombosis and help restore the vessel's natural flexibility.

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