Clemson University Research Foundation

Durable Polymeric Antimicrobial Coating for Orthopedics (2017-059)

Polymer coating provides long-lasting antibiotic dispersion in orthopedic external fixators.

Market Overview

External fixation is a well-established orthopedic practice in which fractured bones or fusion sites are immobilized for healing by placing wires and/or pins into the bone on either side. Unfortunately, both superficial and deep tissue infections are prevalent with the use of external fixators, particularly Staphylococcal infections. The economic burden caused by treating such infections is expected to reach $1.6B annually by 2020. Though other antimicrobial coatings have been developed for use in orthopedics, the process required to insert the hardware into the patient exerts a tremendous shearing force, compromising the stability, longevity and efficacy of the product coating. Clemson researchers have engineered a mechanically-stable antibiotic coating that withstands insertion to disperse a consistent antibiotic dosage throughout the lifespan of the implant.

Application

Antimicrobial coating for orthopedics

Stage of Development

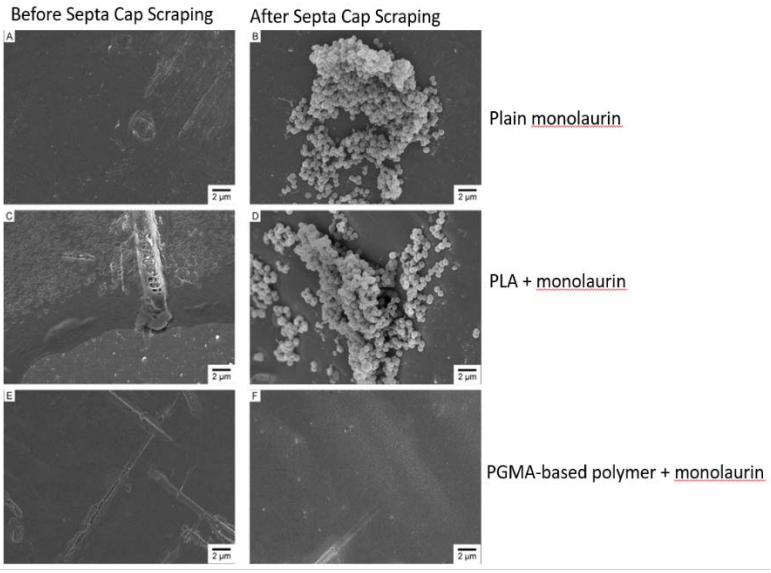
In vitro pre-clinical studies completed

Advantages

- Coating maintains mechanical stability through insertion process, ensuring product safety
- Can be copolymerized with other monomers, allowing for fine-tuning of chemical and physical properties
- Epoxy remains stable under neutral pH conditions, dispersing antibiotic only after insertion

Technical Summary

This highly-adherent polyglycidyl methacrylate-based (PGMA) coating for external fixator hardware resists mechanical shearing and degradation over time, allowing for consistent dispersion of antibiotics at the implant site. The coating consists of a co-polymer of up to three polymers: PGMA, which is responsible for high adhesion to metal, polyoligoethyleneglycol methacrylate (POEGMA), which forms domains for incorporation of hydrophilic drugs, and polylauryl methacrylate (PLMA), which forms domains for incorporation of hydrophobic drugs. Both



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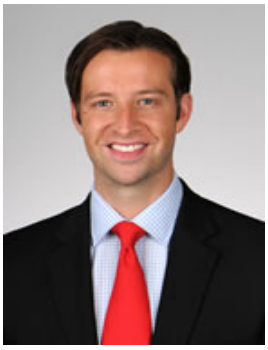
hydrophilic and hydrophobic drugs can be incorporated into PGMA-based films in much higher doses than during a simple drug adsorption. Use of PGMA-based coating allowed for prolonged drug release and increased the drug's long-term storage stability. Such PGMA-based coatings remain stable on metal implants after application of considerable shear forces, which enables incorporation and sustained release for broad range of drugs, including antibiotics, anti-inflammatory drugs, growth factors, and many others.

App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Provisional	United States	62/613,830	NA	2017-059	Dr. Alexey Vertegel, Dr. Christopher Gross, Igor Lusinov

About the Inventor

Dr. Alexey Vertegel is an Associate Professor of Bioengineering at Clemson University. He earned his Ph.D. in Inorganic Chemistry from Moscow State University in 1996. Prior to joining Clemson, he served as a post-doctoral research associate at University of Missouri-Rolla and a research scientist at the Rensselaer Polytechnic Institute. Dr. Vertegel has published over 45 journal articles in both English and Russian and is a member of the Society for Biomaterials and the Materials Research Society. In Clemson's Bionanomaterials Lab he studies nanoparticles for targeted drug delivery, fiber-based biosensors and biodevices, and advanced scanning-probe-microscopy techniques.



Dr. Christopher Gross is an Assistant Professor at the Medical University of South Carolina and an orthopedic surgeon. He graduated from Harvard Medical School in 2009 and specializes in orthopedic foot and ankle surgery. He completed a fellowship at Duke University Medical Center after completing his residency training at Rush University Medical Center. As a foot and ankle surgeon he is particularly interested in cartilage injuries that range from small defects to end-stage ankle arthritis. He hopes to develop and nurture a multidisciplinary research division within foot and ankle surgery with the goals of harnessing the power of biologics and improved implant design.

For More Information

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