Topic of the Speech:
Electrospun Nanofiber and Nanoyarn for Hard and Soft Tissue Regeneration

Professor Xiumei Mo
Donghua University
China

Professor Xiumei Mo is a professor of Biomaterials in Donghua University. She once had two years Postdoc experience in Kyoto University, three years research fellow experience in National University of Singapore, one year visiting professor experience in Aachen University of Applied Science and Technology. Her main research work is electrospinning nanofiber and nanoyarn for different tissue regeneration, including skin, tendon, nerve, blood vessel, bone and cartilage tissue regeneration. She also do hydrogel research and 3D printing scaffolds.

She was granted 38 projects related with nanofiber fabrication for different tissue regeneration and hydrogel as tissue adhesive. She has published more than 450 papers, the papers were cited more than 11,000 times, her H-index is 51. She edited 11 books/chapters, ISI Web of Science showed that she ranking No.7 in the world on electrospun nanofiber publication. She got the Science Technical Invention Awards from Shanghai Municipality in 2008, Science and Technology Progress Awards from State Department of People's Republic of China in 2009, and Nature Science Awards from Shanghai Government in 2015. She is the Committee Members of China Biomaterials Society as well as Biomedical Engineering Society Biomaterials Branch. She is also Vice Chairman of China Composite Materials Society Super-fine Fiber Branch.

ABSTRACT SUBMISSION
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Xiumei Mo*
Donghua University, 2999 Renmin Road North, Songjiang, Shanghai 201620, China
* Email: xmm@dhu.edu.cn

ABSTRACT (NO MORE THAN 500 WORDS:)

Electrospinning nanofiber can biomimetic Extracellular Matrix and suitable for tissue scaffolding. In our research silk-P(LLA-CL) complex nanofibers tube scaffold have been fabricated for nerve tissue engineering, collagen-P(LLA-CL) nanofibers tube scaffold have been fabricated for blood vessel tissue engineering. Coaxial electrospinning has been used to spin the growth factor into nanofibers to promote the tissue regeneration, NGF in nanofiber promoted nerve regeneration, VEGF in nanofiber promoted endothelia cell proliferation.

Here, we report various types of an active wound dressing with extensive physicochemical and biological evaluation. In the first study, we fabricated poly-(L-lactide-co-caprolactone) (PLCL/ silk fibroin (SF) based electrospun nanofibers loaded with Phellodendron. The obtained nanofibers were capable to prevent bacterial growth. Moreover, the nanofibers successfully closed the diabetic wound with complete epithelialization and collagen deposition. The nanofibers mediated gene expression including upregulation of TGF-β, α-SMA, Col1, Col3, and downregulation of proinflammatory cytokines such as IL-1β and TNF-α was observed. Similarly, PLCL/SF based electrospun nanofibers loaded with oregano essential oil (OEO) and PLGA/SF based nanofibers loaded with ZnO nanoparticles were also fabricated. We demonstrated multifunctionality including antibacterial, antioxidant, and in vivo wound healing capabilities. In a subsequent study, we employed a novel strategy to load a volatile compound, OEO, into the core of nanofiber and ZnO into the shell thus enabled dual bioactive agent delivery on the wound site. Physicochemical and mechanical characterization confirmed the nanofiber structure was suitable for wound healing applications. In vitro, biological evaluation confirmed the antibacterial, antioxidant, and cytocompatibility of the nanofibers. Moreover, we demonstrated the diabetic wound healing potential with early wound closure, complete epithelialization, angiogenesis, collagen deposition, and granulation tissue formation. VEGF expression was also studied via immunochemical staining. Moreover, the nanofibers were found to play substantial roles in downregulating the pro-inflammatory cytokines.

Electrospinning fabrication technique most commonly produces relatively 2D mats and the construction 3D structure nanofibers with higher porosity is still a major challenge. In our research, two methods were used to fabricate the 3D nanofiber scaffolds. A dynamic electrospinning method were developed to fabricate the nanoyarn scaffold. The nanoyarn scaffold contained 3D aligned microstructures with larger interconnected pores and higher porosity comparing with nanofiber scaffold. The nanoyarn scaffold have been successfully used for tendon tissue regeneration of rabbit. The nanoyarn has also used to prepare bilayer blood vessel scaffold to be as out layer to regenerate the smooth muscle tissue. Gelatin/PLA nanofiberous 3D scaffold was fabricated by using combined electrospinning and freeze-drying methods. Thus obtained 3D nanofiber scaffold could promote cells infiltration in three dimensionally, it also been succeeded for tissue engineering in rabbit articular cartilage. Gelatin/PLA nanofiberous 3D scaffold also be immobilized with BMP-2 peptides and used for bone tissue regeneration, it helped for critical skull regeneration in rat.