SOFT TISSUE APPROXIMATION AND REPAIR USING LASER-ACTIVATED NANOMATERIALS

Kaushal Rege, Arizona State University, Tempe, AZ 85287, USA
rege@asu.edu

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Approximation and repair of soft tissues is conventionally accomplished using sutures and staples, which are inherently traumatic. Laser-activated tissue sealing is an alternate strategy that facilitates rapid, fluid-tight approximation of ruptured tissues, but the lack of effective materials compromises efficacy. I will discuss our results on the generation, characterization and evaluation of laser-activated nanomaterials in which, gold nanorods (GNRs) are embedded within polypeptide matrices. Irradiation of these nanomaterials with near infrared (NIR) light facilitated a photothermal response, which, in turn, resulted in rapid, fluid-tight sealing and repair of soft tissues both ex vivo and in live animals. Gold nanorods were also incorporated in polypeptide fibers, resulting in the formation of laser-activated sutures which combine the advantages of conventional clinical practice (suturing) with photothermal sealing in a single surgical device. Recent studies indicate that delivery of bioactive compounds in concert with photothermal sealing using nanomaterials facilitate the acceleration of dermal wound healing and repair in live mice. Our results demonstrate that laser-activated nanomaterials can augment and/or replace sutures in several applications including soft tissue trauma, wound healing and grafts.