

## ARTICLE

Received 22 Oct 2013 | Accepted 5 Feb 2014 | Published 4 Mar 2014

DOI: 10.1038/ncomms4385

# The use of silk-based devices for fracture fixation

Gabriel S. Perrone<sup>1,2</sup>, Gary G. Leisk<sup>2</sup>, Tim J. Lo<sup>1</sup>, Jodie E. Moreau<sup>1</sup>, Dylan S. Haas<sup>1</sup>, Bernke J. Papenburg<sup>1</sup>, Ethan B. Golden<sup>1</sup>, Benjamin P. Partlow<sup>1</sup>, Sharon E. Fox<sup>3</sup>, Ahmed M.S. Ibrahim<sup>4</sup>, Samuel J. Lin<sup>4</sup> & David L. Kaplan<sup>1</sup>

Metallic fixation systems are currently the gold standard for fracture fixation but have problems including stress shielding, palpability and temperature sensitivity. Recently, resorbable systems have gained interest because they avoid removal and may improve bone remodelling due to the lack of stress shielding. However, their use is limited to paediatric craniofacial procedures mainly due to the laborious implantation requirements. Here we prepare and characterize a new family of resorbable screws prepared from silk fibroin for craniofacial fracture repair. *In vivo* assessment in rat femurs shows the screws to be self-tapping, remain fixed in the bone for 4 and 8 weeks, exhibit biocompatibility and promote bone remodelling. The silk-based devices compare favourably with current poly-lactic-co-glycolic acid fixation systems, however, silk-based devices offer numerous advantages including ease of implantation, conformal fit to the repair site, sterilization by autoclaving and minimal inflammatory response.

<sup>1</sup>Department of Biomedical Engineering, Tufts University, Medford, Massachusetts 02155, USA. <sup>2</sup>Department of Mechanical Engineering, Tufts University, Medford, Massachusetts 02155, USA. <sup>3</sup>Beth Israel Deaconess Medical Center, Department of Pathology, Harvard Medical School, Boston, Massachusetts 02215, USA. <sup>4</sup>Divisions of Plastic Surgery and Otolaryngology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts 02215, USA. Correspondence and requests for materials should be addressed to S.J.L. (email: sjlin@bidmc.harvard.edu) or to D.L.K. (email: David.Kaplan@tufts.edu).