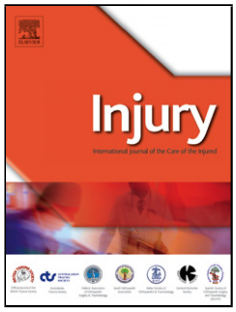

Title: Minimally invasive treatment of displaced femoral shaft fractures with a teleoperated robot-assisted surgical system

Authors: Qing Zhu, Bin Liang, Xingsong Wang, Xiaogang Sun, Liming Wang

PII: S0020-1383(17)30433-3
DOI: http://dx.doi.org/doi:10.1016/j.injury.2017.07.014
Reference: JINJ 7304

To appear in: *Injury, Int. J. Care Injured*

Received date: 1-5-2017
Revised date: 5-7-2017
Accepted date: 10-7-2017

Please cite this article as: Zhu Qing, Liang Bin, Wang Xingsong, Sun Xiaogang, Wang Liming.Minimally invasive treatment of displaced femoral shaft fractures with a teleoperated robot-assisted surgical system.*Injury* http://dx.doi.org/10.1016/j.injury.2017.07.014

Minimally invasive treatment of displaced femoral shaft fractures with a teleoperated robot-assisted surgical system

Qing Zhu[a1], Bin Liang[b1], Xingsong Wang[a*], Xiaogang Sun[a], Liming Wang[b]

[a] School of Mechanical Engineering, Southeast University, Nanjing, Jiangsu 211189, P. R. China

[b] Department of Orthopaedic Surgery, Nanjing First Hospital, Nanjing Medical University, Nanjing, Jiangsu 210006, P. R. China

Correspondence: Xingsong Wang School of Mechanical Engineering, Southeast University, Nanjing, Jiangsu, 211189, P. R. China

E-mail: xswang@seu.edu.cn **Tel: (+86)-25-52090517**

[1] Both authors contributed equally.

Abstract

Background: Minimally invasive surgical operation of intramedullary (IM) nailing is a standard technique for treating diaphyseal fractures. However, in addition to its advantages, there are some drawbacks such as the frequent occurrence of malalignment, physical fatigue and high radiation exposure to medical staff. The use of robotic and navigation techniques is promising treatments for femoral fractures.

Materials and methods: This paper presents a novel robot-assisted manipulator for femoral shaft fracture reduction with indirect contact with the femur. An alternative clinical testing model was proposed for orthopedic surgeons to practice femoral fracture reduction. This model imitates the human musculoskeletal system in shape and functional performance. The rubber tube simulate muscles providing contraction forces, and the silicone simulates passive elasticity of muscles. Two-group experiments were performed for studying feasibility of the teleoperated manipulator.

Results: The average operative time was about 7 minutes. In the first group experiments, the femur axial, antero-posterior (AP) and lateral views mean errors were 2.2mm, 0.7mm and 1.1mm, respectively, and their maximums were 3.0mm, 0.9mm and 1.5mm; the mean errors of rotation were 0.8° around x-axis, 1.6° around y-axis, 2.0° around z-axis, and their maximums were 1.1°, 2.2°, 2.9°, respectively. For the second group experiments, the femur axial, AP and lateral views mean errors were 1.8mm, 0.4mm and