

Manual vs. robotic milling parameters for development of a new robotic system in cranial surgery

M. Engelhardt^{a,*}, P. Bast^b, W. Lauer^b, V. Rohde^c,
K. Schmieder^a, K. Radermacher^b

^a *Department of Neurosurgery, Knappschaftskrankenhaus/Ruhr-University Bochum, In der Schornau 23-25, Bochum, NRW 44892, Germany*

^b *Helmholtz-Institute for Biomedical Technologies, RWTH-Aachen University, Germany*

^c *Department of Neurosurgery, University Hospital RWTH, Aachen, Germany*

Abstract. The milling of bone is a time-consuming and straining effort during surgery at the cranial vault. In order to determine possible advantages of a robotic system, the registration of different milling parameters during defined surgical procedures was the aim of this study. Eleven neurosurgeons were asked to mill a bovine scapula. The task consisted of geometric figures (one line and a circle) that had to be milled in a depth of 3 mm. Main focus was laid on the accuracy of the milling. In addition, the registered parameters such as forces, temperature and speed will be used as a reference for the design and validation of the robotic system. The same task was done by a robotic (hexapod) system, constructed at the Helmholtz-Institute Aachen (HIA). In comparison with the surgeon, the robotic system showed a higher accuracy at a greater velocity. The forces and temperatures showed minor differences. If further test results are consistent, it would be advantageous to use a robotic system to perform large craniectomies, especially in cosmetically relevant areas due to its advantage in accuracy and speed compared to a surgeon. © 2004 CARS and Elsevier B.V. All rights reserved.

Keywords: Bone milling; Craniotomy; Robot-assisted surgery

1. Introduction

In cases of metastatic involvement of the cranial vault or in some meningiomas the surgeon has to handle destructed or tumor-infiltrated skull during craniotomy and craniectomy, in a large number of cases located at the forehead of the patient. Due to the cosmetically relevant area a precise milling is needed, especially in case a template and a prefabricated implant has to be used. Resection of large pathologies is a time-consuming and straining surgical procedure.

* Corresponding author. Tel.: +49-2342993602; fax: +49-2342993609.

E-mail address: martin.engelhardt@ruhr-uni-bochum.de (M. Engelhardt).

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Table of Contents Manual Vs Robotic Milling Parameters For

1. Understanding the eBook Manual Vs Robotic Milling Parameters For
 - The Rise of Digital Reading Manual Vs Robotic Milling Parameters For
 - Advantages of eBooks Over Traditional Books
2. Identifying Manual Vs Robotic Milling Parameters For
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Manual Vs Robotic Milling Parameters For
 - User-Friendly Interface
4. Exploring eBook Recommendations from Manual Vs Robotic Milling Parameters For
 - Personalized Recommendations
 - Manual Vs Robotic Milling Parameters For User Reviews and Ratings
 - Manual Vs Robotic Milling Parameters For and Bestseller Lists
5. Accessing Manual Vs Robotic Milling Parameters For Free and Paid eBooks
 - Manual Vs Robotic Milling Parameters For Public Domain eBooks
 - Manual Vs Robotic Milling Parameters For eBook Subscription Services
 - Manual Vs Robotic Milling Parameters For Budget-Friendly Options
6. Navigating Manual Vs Robotic Milling Parameters For eBook Formats

- ePub, PDF, MOBI, and More
 - Manual Vs Robotic Milling Parameters For Compatibility with Devices
 - Manual Vs Robotic Milling Parameters For Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Manual Vs Robotic Milling Parameters For
 - Highlighting and Note-Taking Manual Vs Robotic Milling Parameters For
 - Interactive Elements Manual Vs Robotic Milling Parameters For
 8. Staying Engaged with Manual Vs Robotic Milling Parameters For
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Manual Vs Robotic Milling Parameters For
 9. Balancing eBooks and Physical Books Manual Vs Robotic Milling Parameters For
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Manual Vs Robotic Milling Parameters For
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Manual Vs Robotic Milling Parameters For
 - Setting Reading Goals Manual Vs Robotic Milling Parameters For
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Manual Vs Robotic Milling Parameters For
 - Fact-Checking eBook Content of Manual Vs Robotic Milling Parameters For
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
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