ABSTRACTS OF THE 4th EJIL

LAETA Young Researchers Meeting

4º Encontro de Jovens Investigadores do LAETA

BOOK OF ABSTRACTS

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PREFACE

The 4th LAETA Young Researchers Meeting (4EJIL – 4º Encontro de Jovens Investigadores do LAETA) is held from November, 9th to 10th of 2017 in Covilhã, Portugal. Since its beginning, the EJIL is a continuous source of sharing state-of-the-art developments in the scientific and technological fields of Energy, Transports and Aeronautics and a large number of applications in the field of Mechanical Engineering. This meeting also offers a unique opportunity for joining young researchers of LAETA (Laboratório Associado de Energia, Transportes e Aeronáutica) units, namely: IDMEC, INEGI, ADAI, and AeroG. One main objective of this meeting is the promotion and encouragement of interdisciplinary discussions among young researchers.

This Book of Abstracts contains the synthesis of the papers accepted for oral presentation and is organized by the Thematic Research Lines of LAETA, which cover the research fields of Energy, Aeronautics and Space, Advanced Manufacturing, Advanced Materials, Biomechanics, Fires, Engineering Design and Engineering Systems.

On behalf of the Organizing Committee, I would like to express our gratitude to those who contributed to the success of this meeting. The assistance provided by the Advisory Committee is highly appreciated. A special thanks also goes to the participants and the authors, without whom the 4EJIL, and this book, would not be possible.

And last, but not least, I would like to manifest my sincere gratitude to my colleagues of the Organizing Committee not only for the efficient work performed but especially for the friendly and helpfulness environment lived during the time of preparation of the meeting.

Covilhã, November 9, 2017

André R. R. Silva

STRAIN ANALYSIS IN THE DRILLING OF HUMAN AND BOVINE BONE

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Keywords: Bovine Bone, Human Cadaveric Tibiae, Drilling, Strain.

Abstract.

The growing importance of bone surgical drilling procedures has motivated the development of assessment methods aimed to prevent bone injury. Different studies on the parameters influencing bone drilling have been published. However, most of the results are based only in the analysis of temperatures. There is a lack of information on the mechanical damage on bone, especially about bone tissue surface integrity and the strain distribution during drilling. The challenge during drilling should not be limited to avoid thermal damage but also to predict the strains affecting the bone, since the cutting force and the accuracy of the osteotomy depends upon the surgeon's manual skills.

The present study was designed for the evaluation of strains generated during the cortical bone drilling, as function of different drilling parameters. An experimental approach has been conducted using ex-vivo bovine bones and human cadaveric tibiae. The bones were instrumented with linear strain gauges at flat surfaces of bone tissue during the drilling process. The drilling parameters selected for this study consist in the use of three different drill speeds (520, 900 and 1370 rpm). The feed-rate was not controlled, since in clinical practice this parameter varies from surgeon to surgeon. All holes were performed using a vertical machine with a twist drill bit with 4 mm of diameter and a point angle equal to 118°. The tests were conducted at room temperature (20-23° C) without applying cooling at drilling zone.

This study allowed the analysis and comparison of the strains generated during drilling of ex-vivo bovine bones and human cadaveric bones. All results show that the increase of drill speed leads to an increase of the strain during the drilling. It was noted that the strains tend to increase with tool penetration and, consequently, the osteotomy depth. The present results are consistent with our previous studies made using polyurethane foam materials with properties that are similar to the human cadaveric bone.