

Evaluation of Bone-Implant Contact (BIC) and titanium implant stability in an experimental animal model: an in vivo study



Gregory Hriczo-Koperdak,¹ Sandor Farkasdi,¹ Tamas Harangozo,¹ Szilvia Koncz,¹ David Pammer,² Agnes Kocsis,² Marco Berardini,³ Jozsef Blazsek,¹ Gabor Varga¹

¹ SEMMELWEIS UNIVERSITY, Faculty of Dentistry, Department of Oral Biology, Budapest, Hungary

² Budapest University of Technology and Economics, Hungary

³ Università degli Studi Gabriele D'Annunzio, Italy



SUMMARY. The goal of this study was having useful datas for clinicians with which the **stabilities of implants** can be **quantified** and so the **maximal loading** can be defined correctly.

INTRODUCTION. **Osseointegration** was introduced by P. I. Brånemark as a direct, rigid fixation of titanium implants within the bone tissue. A **new experimental model** was developed at our department to evaluate osseointegration and new bone formation, named **OSSI (#1)**. In the past few months we succeeded in the adaptation of our model to a non-invasive measurement method - **Resonance Frequency Analysis (RFA)**.

MATERIALS AND METHODS. 51 female Wistar **rats** were used (#3). 4, 8 and 16 weeks after surgery, rats were sacrificed under Nembutal anesthesia and **caudal vertebrae** were harvested. Implant stability was measured by using a non-invasive system utilizing **RFA** (Osstell ISQ, Sweden). Biomechanical properties were further characterized by measuring the **maximum extraction force** (#4). **Histomorphometric** (#7) and **micro-CT analysis** of the specimens were also performed in order to assessing stiffness of the tissue-implant interface.

RESULTS. A **strong correlation** was found between non-invasive and invasive implant stability evaluation methods (#5) (Spearman, $r=0.8498$). We observed **statistically significant differences** (Wilcoxon) between the three (4, 8, 16 weeks) evaluation periods, due to the gradually increasing strength of osseointegration (#6). The average values of RFA were 23.98, 34.66 and 52.85 ISQ. The outcome of the pull-out test has shown 24, 56.16 and 116.125 Newtons in average.

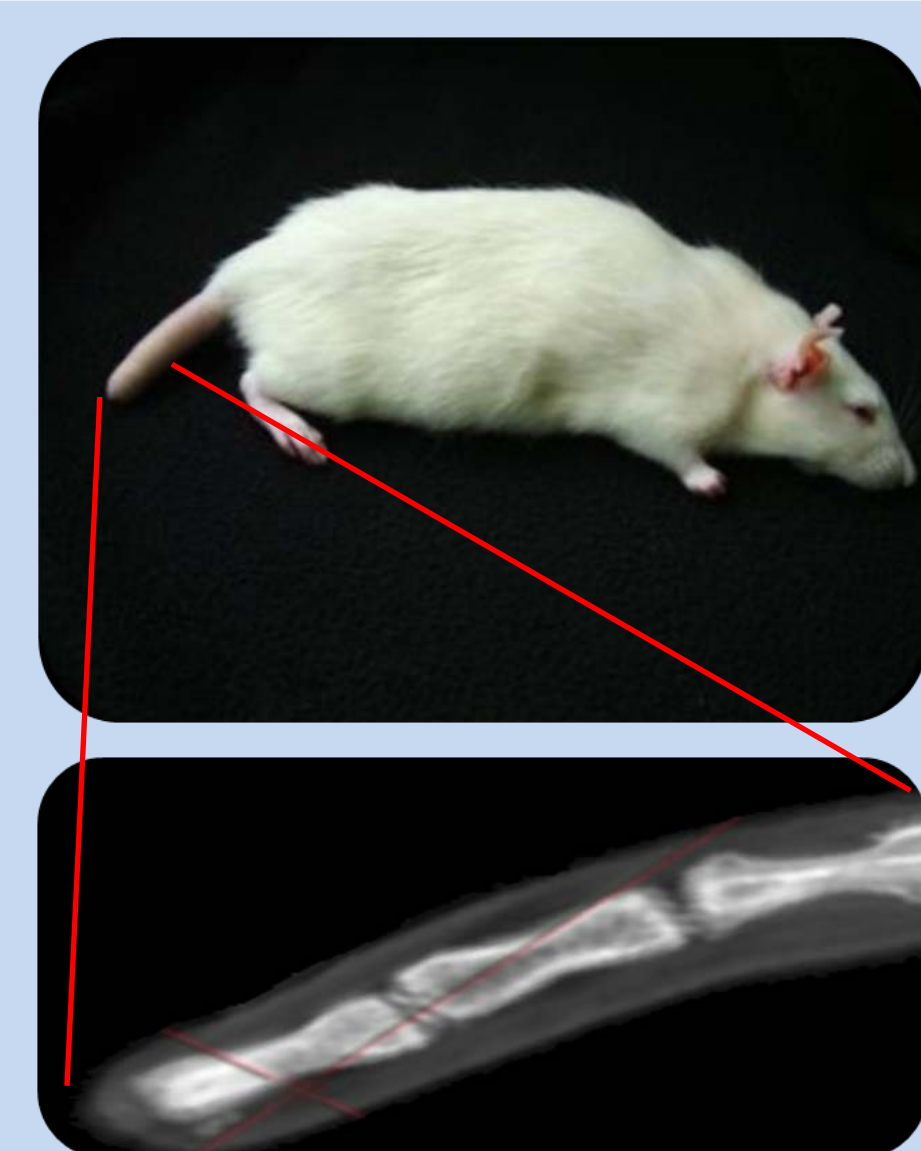
In our conditions:

1 N/mm² = 10.16 ISQ/mm²

1 ISQ/mm² = 0.098 N/mm²

DISCUSSION AND CONCLUSIONS. OSSI model had been **adaptated** to the new RFA technique **successfully**. We **established to calculate the value** of titanium implant fixation within the bone surface. Our study may provide such results to the clinics of orthopedic traumatology as well as dentistry, which are essential in validating the Bone-Implant Contact, and planning implantological procedures.

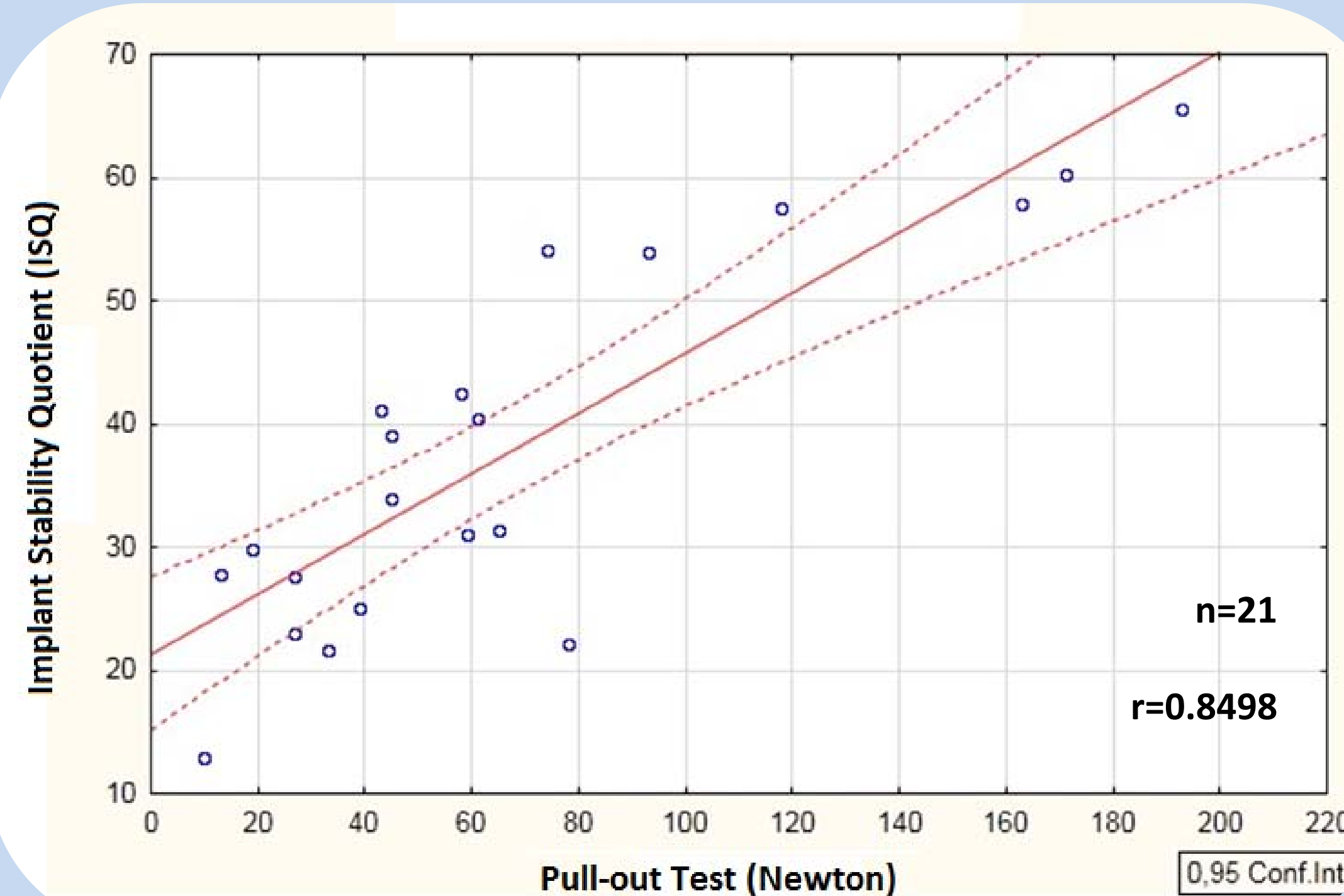
CLINICAL IMPACT. The success of our work can be guaranteed with considerable probability since missed teeth functionally can only be reconstructed and rebuilt by an implantological procedure.



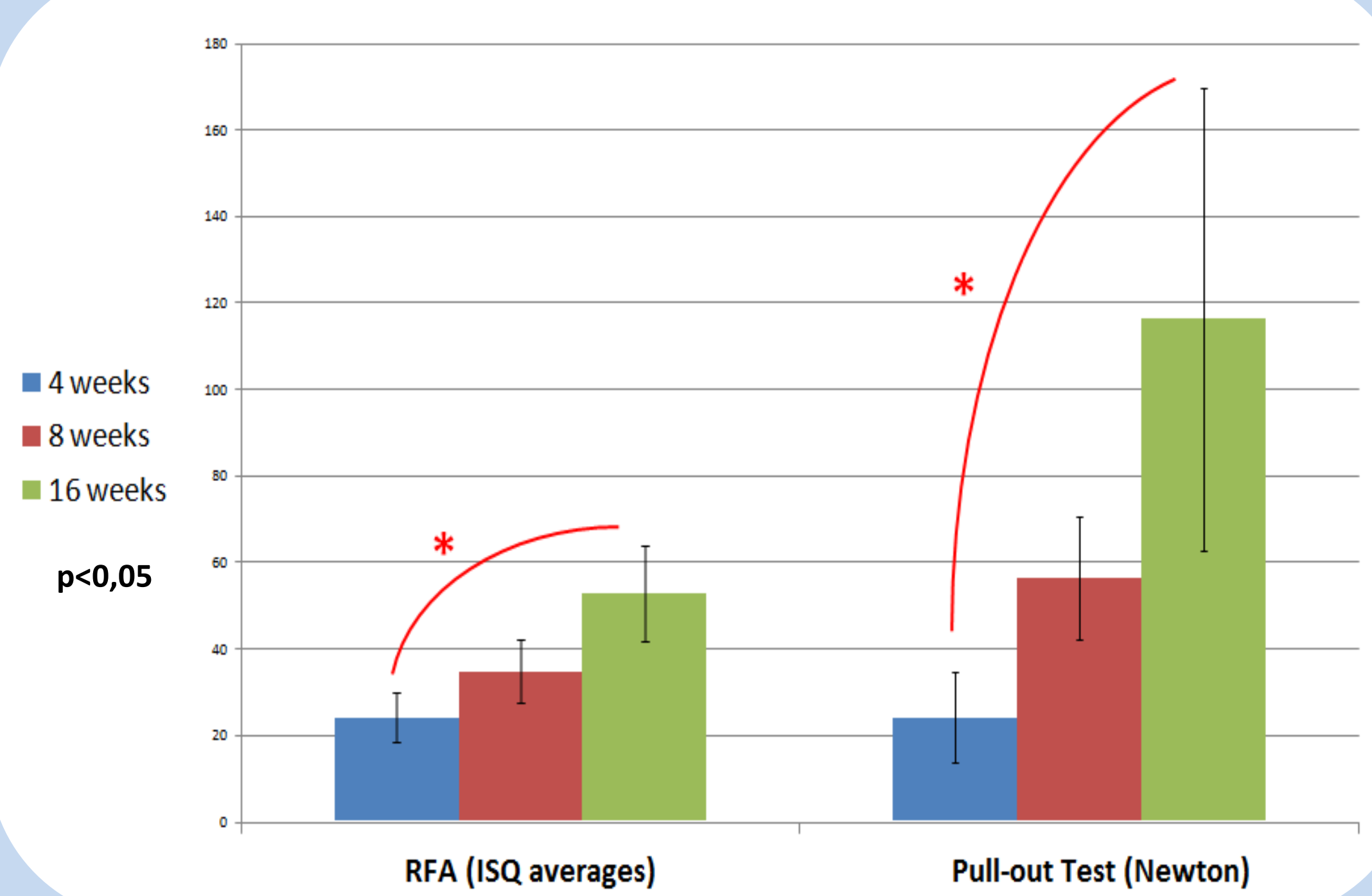
#1 Anatomical characteristics



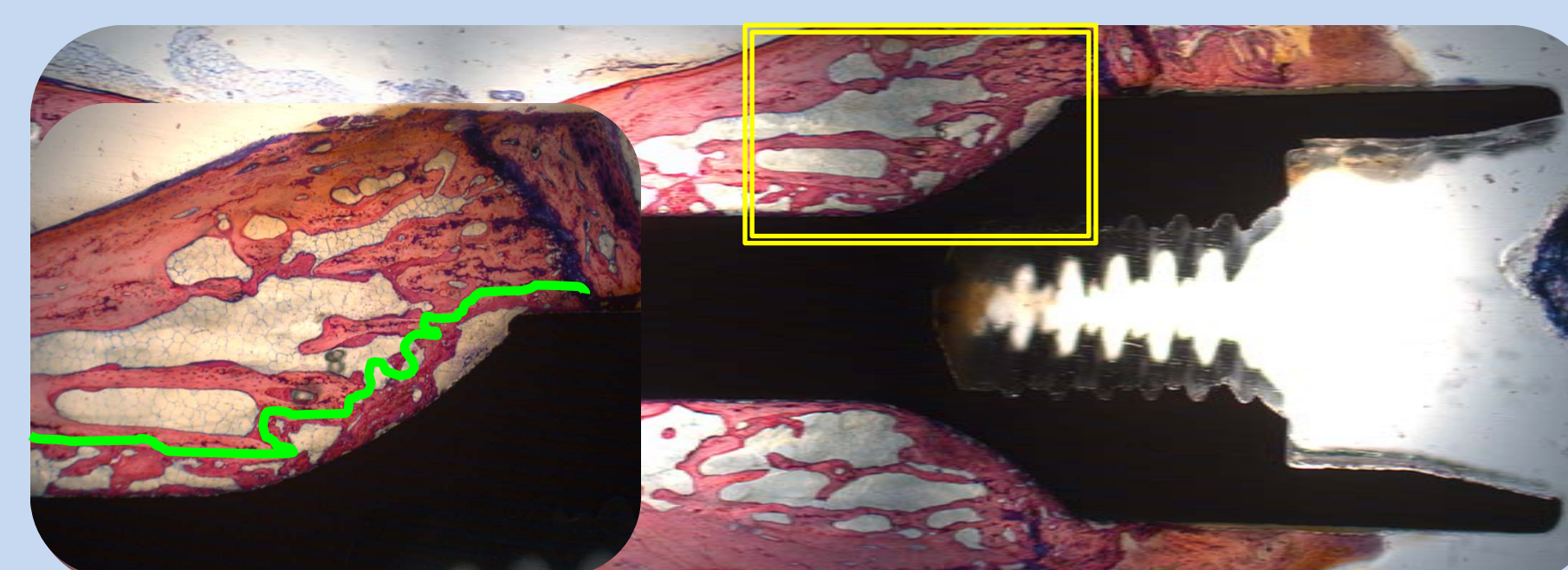
#2 Titanium implants and schematic illustration (blueprint)



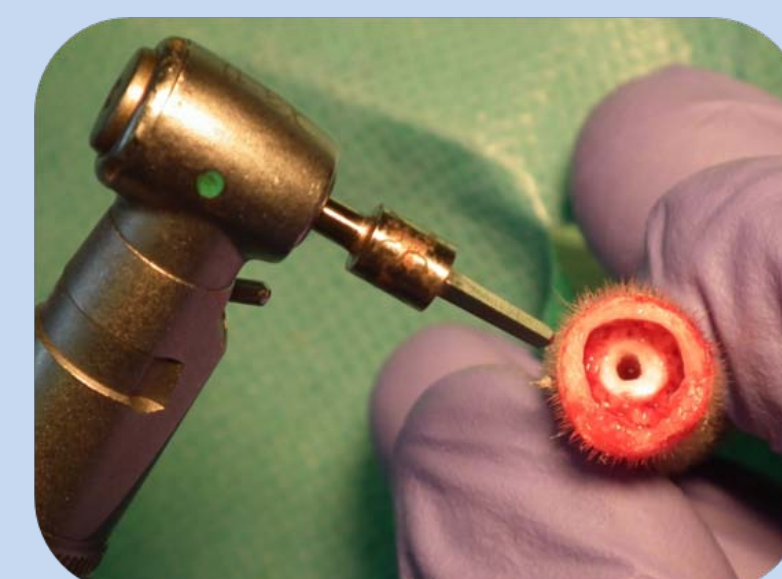
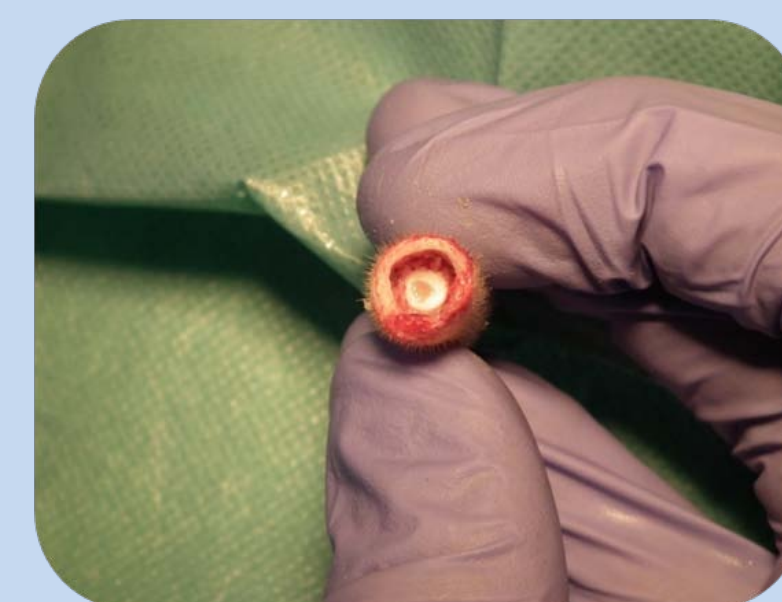
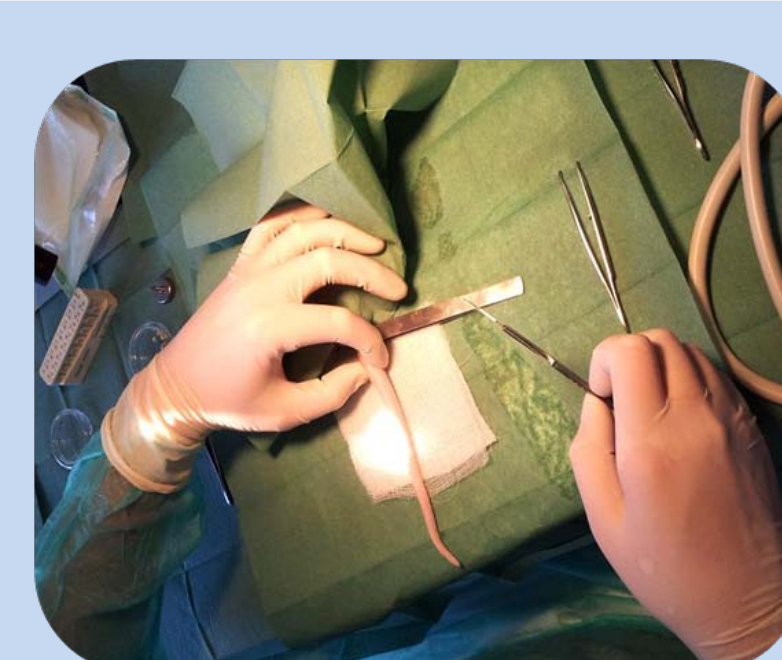
#5 Correlation between stability measurement techniques in vertebrae



#6 RFA and Pull-out Test in vertebrae



#7 Histological analysis of osseointegrated implant and new bone formation



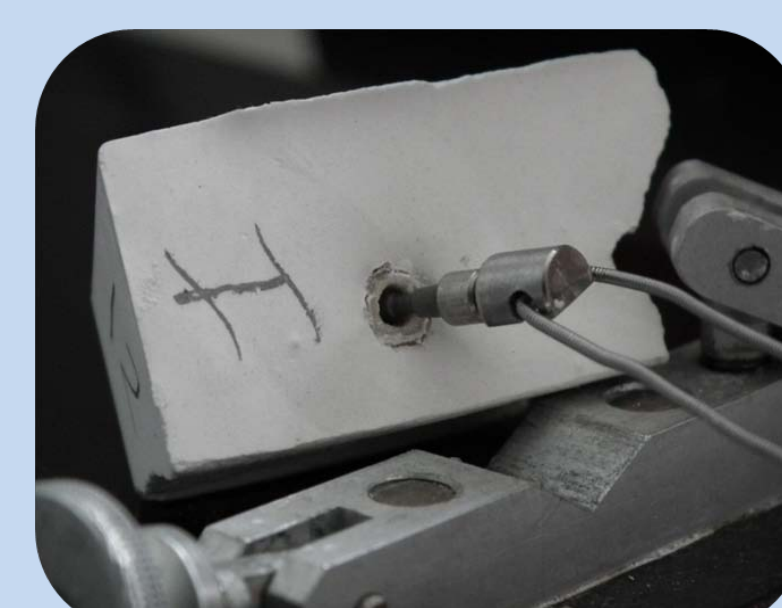
#3 Steps of surgical procedure



RFA (Osstell ISQ)



Pull-out Test (Tenzi)



#4 Steps of evaluation



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EUROPEAN STUDENTS' CONFERENCE – CHARITÉ UNIVERSITÄTSMEDIZIN BERLIN –
CHARITÉPLATZ 1 – D-10117 BERLIN

Gregory Hriczo-Koperdak,
10-14. Vaskapu u.
1097 Budapest
Hungary



Julia Neugebauer
Programme & Science

Telefon +49 30 450 576040
Telefax +49 30 450 576935
julia.neugebauer@esc-berlin.com

www.esc-berlin.com

Berlin, 28/07/14

Letter of Recommendation for the European Students' Conference in Berlin

Dear Gregory Hriczo-Koperdak,
ESC-ID: A869

Congratulations! We are pleased to confirm that you have been accepted as an active participant at the 25th European Students' Conference (ESC) with your abstract:

"Evaluation of Bone-Implant Contact (BIC) and titanium implant stability in an experimental animal model: an in vivo study"

The ESC will take place from **17th - 20th of September 2014** at Charité Berlin and is titled ***"Rethinking Medical Research – how do we achieve innovation?"***

The ESC was founded in 1989 and has become one of the biggest biomedical student conferences in Europe. It is an important annual gathering for students and young professionals from all medical fields and a great opportunity to learn about new scientific findings and approaches.

For further information and questions please do not hesitate to contact us via e-mail: info@esc-berlin.com or phone: +49 30 450 576040

We hope that you will join us in making this year's European Students Conference a true success.

We are looking forward to welcoming you in Berlin!

Sincerely Yours,



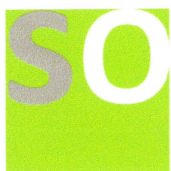
Julia Neugebauer
On behalf of the Organizing Committee

25th EUROPEAN STUDENTS' CONFERENCE

Charitéplatz 1
10117 Berlin

Telefon +49 30 450 576040
Telefax +49 30 450 576935

info@esc-berlin.com
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Peter Grabitz

Project Coordinator

25th ESC Organising Committee

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Prof. Dr. Annette Grüters-Kieslich

Dean

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