15th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering
and
3rd Conference on Imaging and Visualization
CMBBE 2018
P. R. Fernandes and J. M. Tavares (Editors)

Abstract ID-22

ASSESSING DENTAL IMPLANT STABILITY USING A QUANTITATIVE ULTRASOUND TECHNIQUE AND RESONANCE FREQUENCY ANALYSIS

Romain Vayron[(1)], Vu-Hieu Nguyen[(2)], Guillaume Haiat[(1)]

[(1)]CNRS, France
romain.vayron@u-pec.fr, guillaume.haiat@univ-paris-est.fr
[(2)]UPEC, France
vu-hieu.nguyen@u-pec.fr

Keywords: Dental implant, Stability, Quantitative ultrasound, Resonnance frequency analysis

Summary: The implant primary stability is an important factor for the implant success and is determined by the biomechanical quality of bone tissue around the implant. Radiofrequency analyses (RFA) and quantitative ultrasound (QUS) methods have been suggested to assess implant stability. The purpose of this study was to compare the results obtained using these two techniques applied to the same dental implants inserted in bone mimicking phantoms. The reproducibility of the two techniques was determined for each implant. Different values of trabecular bone density (#10, #20, #30 PCF) and cortical thickness were considered to assess the effect of bone quality on the ultrasonic indicator (UI) and on the ISQ values. The effect of the implant insertion depth and of the final drill diameter (1 or 2 mm) was also investigated.
ISQ values increase and UI values decrease when i) the bone density increase, ii) cortical thickness increase, and iii) the implant is screwed in the phantom. The UI values are significantly different for all final drill diameters except for 2.8 and 2.9 mm, while the ISQ values are similar for all final drill diameters lower than 3.2 and higher than 3.3. The error realized on the estimation of the trabecular density (respectively cortical thickness and insertion depth) with the QUS device is around 4 (respectively 8 and 4) times lower compared to that made with the RFA technique.
The results show that ultrasound technique provides a better estimation of different parameters related to the implant stability compared to the RFA technique.