CBCT bone quantification for preoperative planning of oral implant placement

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CBCT is an important tool for planning the implant treatment due to can perform the 3D information about the alveolar bone morphology. The recent studies demonstrated the high accuracy of linear measurements of CBCT equipments for alveolar bone dimension but their correlation with the outcome of the surgery is still insufficient demonstrated. The aim of this study was to compare the accuracy of cone beam computed tomography (CBCT) for quantitative and qualitative assessment of alveolar bone with intra-surgical diagnosis.

Material and methods: Two groups of 20 patients each of them, partially edentulous and with clinical indication for dental implants, were scanned with 2 different CBCT machines: NewTom 3G (Verona, Italy) and Scanora 3D in two different clinics (Cluj University and Leuven Katholieke Universiteit). An individualized template with radio-opaque marker or the fixed anatomical landmarks were used as a guide for planning of implant position and angulations and allowed creating a reference on 3D images and surgical implant placement. Five examiners assessed the bone quantity and quality on CBCT images using Lekholm and Zarb classification and the results were compared with the same indexes evaluated during the surgery. The available height and width of the bone were registered for each implant site on CBCT reformatted images. During the surgery were evaluated the bone quality and quantity and the length, diameter and position of the implants and the outcomes were correlated with CBCT planned parameter.

Results: The Spearman rank correlation demonstrated that there is a significant correlation between the bone quantity and quality parameters on CBCT and on surgical examination (p=.0003 and p=.0009 respective). The mean of the difference between the planned dimensions of implants and the real dimension of placed implants was 0.98mm for length and 1.04mm for diameter but the available bone was with 2.77mm [95%CI 1.59 -3.95] higher and with 4.01mm [95%CI 1.59 -3.95] wider than the implants placed.

Conclusion: The results showed that CBCT examination is a helpful examination for the assessment of the available bone and for pre-operative implant planning due to the strong correlation between CBCT and intrasurgical assessment of bone quantity and quality and implant dimension.