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Comparison of direct linear measurements on dental plaster cast and digital measurements obtained from laser scanner and Cone-Beam CT dental models

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Different dental imaging technologies are now daily used in clinical practice to evaluate oral anatomy. These new techniques allow to replace dental plaster casts with digital models that are easier to manage and store. Such models can be acquired with optical methods like laser scanner, stereophotogrammetry and intraoral scanner or reconstructed by 3D CT or CBCT images [1]. Since these digital casts are used in clinical routine, it is important to evaluate accuracy and reliability of measurements taken from them, in relation to traditional methods [2]. We wanted to compare linear measurements taken on digital models obtained from CBCT images and laser scanner surfaces, with direct measurements obtained with digital calliper on dental plaster casts. Data from 6 adult Caucasian subjects with full dentition, no history of implant surgery and without dental filling were obtained. The absence of implants and metal fillings was selected as inclusion criterion to reduce the presence of metal artefacts that can affect the measurement process. All patients were retrospectively selected from a clinical database and underwent CBCT examination for clinical reasons uncorrelated with this study. Six dental distances in the upper and six in the lower jaw were examined: the mesio-distal distance of teeth 21, 23, 24 and 26, the palatal-vestibular distance of teeth 24 and 26, and the corresponding distances on teeth 41, 43, 44 and 46. All measurements were performed using: 1) a digital calliper on dental plaster casts; 2) a virtual calliper on digital models obtained from CBCT images; and 3) a virtual calliper on laser scanner surfaces. Kruskal-Wallis test compared measurements performed with the 3 different techniques. There was no statistical significant difference among different techniques for all measurements ($p>0.05$) except for one distance, the mesio-distal distance of tooth 24 ($p<0.05$). Measurements on digital dental models seem as reliable as direct measurements performed on dental plaster casts. Results are promising, nevertheless further evaluation on a larger sample is advised.

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Keywords
Dental model; CBCT; laser scanner; calliper.

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