A comparison of Six Cone Beam Computed Tomography Systems for Image Quality and Detection of Simulated Canine Impaction-Induced External Root Resorption in Maxillary Lateral Incisors

Ali Alqerban [a], Reinhilde Jacobs [b], Steffen Fieuws [c], Olivia Nackaerts [b], Guy Willems [a] The SEDENTEXCT Project Consortium [d]

[a] Department of Orthodontics, Faculty of Medicine School of Dentistry, Oral Pathology and Maxillo-Facial Surgery Katholieke Universiteit Leuven, Belgium.
[b] Oral Imaging Center. Faculty of Medicine, School of Dentistry, Oral Pathology and Maxillo-Facial Surgery, Katholieke Universiteit Leuven, Belgium.
[c] Statistical consultant, I-BioStat. Department of Public Health. Katholieke Universiteit Leuven and Universiteit Hasselt, Belgium.
[d] Listing of partners on www.sedentexct.eu

Introduction:
The most frequent adverse effect of canine impaction is resorption of the adjacent incisors. The subjective image quality and radiographic diagnostic accuracy for detection of simulated canine-induced external root resorption lesions in maxillary lateral incisors was compared between six different CBCT systems *in vitro*.

Methods:
A child cadaver skull in the early mixed dentition was obtained. This skull had an impacted maxillary left canine and allowed a reliable simulation. Simulated root resorption cavities were created in eight extracted maxillary left lateral incisors by the sequential use of 0.16 mm diameter round burs in the distopalatal root surface. Cavities of varying depths were drilled in the middle or apical thirds of each tooth root according to 3 set-ups: slight (0.15, 0.20, and 0.30 mm), moderate (0.60 and 1.00 mm), and severe (1.50, 2.00, and 3.00 mm). The lateral incisors, including two intact teeth were repositioned individually in the alveolus with approximal contacts to the impacted maxillary left canine. Six sets of radiographic images were obtained with 3D Accuitomo-XYZ Slice View Tomograph (J. Morita, Kyoto, Japan), Scanora 3D CBCT (Soredex, Tuusula, Finland), Galileos 3D comfort (Sirona dental systems Inc., Bensheim, Germany), Picasso Trio (E-WOO Technology Co. Ltd, Giheung-gu, Republic of Korea), Kodak 9000 3D (Trophy, Croissy-Beaubourg, France), and ProMax 3D (Planmeca OY, Helsinki, Finland) for each tooth setup. The CBCT images were acquired and subsequently analyzed by 12 observers. Linear models for repeated measures were used to compare between CBCT systems the image quality and the degree of agreement between the diagnosed severity of root resorption and the true severity.

Results:
The differences in the image quality between CBCT systems were statistically significant ($p<0.001$). The results of the presence of root resorption scores between CBCT systems reveal a significantly higher score for Promax when compared to Galileos and Kodak. However, the differences in the agreement between the diagnosed severity of the root resorption and the true severity for all resorption sizes were not found significantly different ($p>0.05$) among the different CBCT systems.

Conclusions:

High image quality is important when detecting root resorption. The CBCT systems used in this study presented high accuracy with no significant difference between CBCT systems in the detection of the severity of root resorption.