

Comparison of Anterior Maxillary root surface areas in patients with Normal overjet and Large overjet using Cone-beam Computed Tomography



Key words : CBCT image, root surface area, overjet, functional force



Objective

In particular, comparing the root surface area of maxillary anterior teeth between patients with normal overjet (2-4 mm) and those with large overjet (>4 mm) facilitates the decision for proper force usage. By using technology in directly measure tooth in jaw without extraction is the other way of reducing selection bias.

Background

Orthodontics involves the correction of malpositioned teeth and jaws with the least damage to the periodontal support or side effects such as root resorption, decrease alveolar bone crest level and gingival recession. This is achieved by using a proper force to allow proper alveolar bone remodeling. Knowing the root surface area that need to be moved allows the operator to use a proper force magnitude.

Material and method

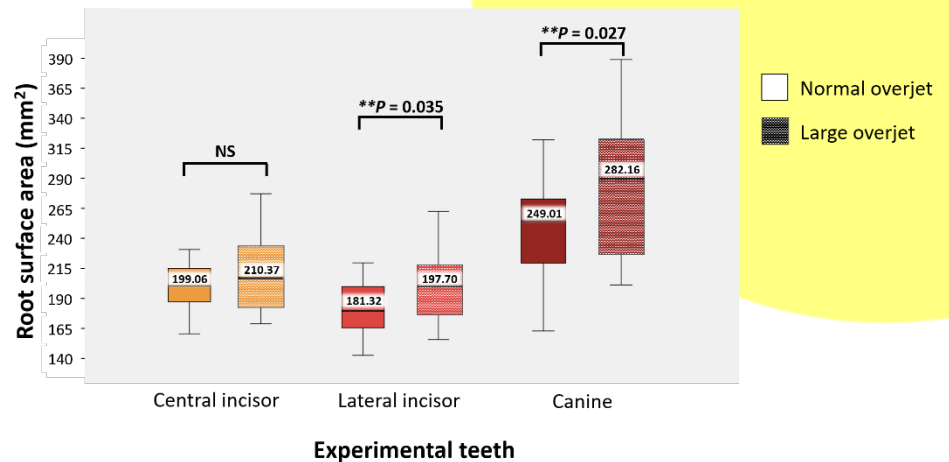
Pretreatment CBCT images of 24 Thai orthodontic patients with normal overjet and large overjet are used. All CBCT images are produced using a ProMax 3D and is categorized as: maxillary central incisor, maxillary lateral incisor and maxillary canine. The surface area apical to the CEJ is measured as the root surface area of each tooth. The data is analyzed using descriptive analysis (means and standard deviations) using SPSS. The unpaired t-test is used to analyze differences between measurements from the left side and the right side. An independent t-test is used to compare the means of the two groups.

Results

Each CBCT image includes 6 anterior permanent teeth on both sides. The sample number are 24 per tooth type per group. The patients mean age is 19.75 ± 2.25 years old. The mean and standard deviation of root surface areas are presented in Table 1.

The mean of maxillary anterior teeth ranges from 181.32 - 282.16 mm². The largest is of the maxillary canine in large overjet patients (282.16 ± 54.51 mm²). The smallest is of the maxillary lateral incisors in normal overjet patients (181.32 ± 23.42 mm²) (Fig 2).

The root surface area of maxillary anterior teeth in normal overjet patients is smaller than large overjet patients, but only the root surface area of lateral incisor and canine are significantly smaller than large overjet ($P = 0.035$, $P = 0.027$, respectively).



** Significant difference: $P < 0.05$, NS: Non-significant difference: $P \geq 0.05$
Fig. 2 Box plot show root surface area of maxillary anterior teeth in normal overjet and large overjet

Type type	Overjet	N	Min	Max	Mean	Standard deviation	Standard error of mean
Central incisor	Normal	24	160.49	230.68	199.06	± 20.43	4.17
	Large	24	168.91	277.17	210.37	± 31.89	6.51
Lateral incisor	Normal	24	142.55	219.62	181.32	± 23.42	4.78
	Large	24	155.73	262.42	197.70	± 28.63	5.84
Canine	Normal	24	163.25	322.29	249.01	± 46.01	9.39
	Large	24	201.52	389.02	282.16	± 54.51	11.13

Table 1. The root surface area of maxillary anterior teeth of this study

Conclusions

The root surface areas as measured in CBCT images in normal overjet pattern are significantly smaller than in large overjet pattern in lateral incisor and canine. These findings suggest that the overjet pattern may be associated with root surface area. For future studies and clinical decisions, the reported mean root surface areas can be used as a baseline. For example, they can be used to identify the amount of force for orthodontic movement for each patient or overjet type.

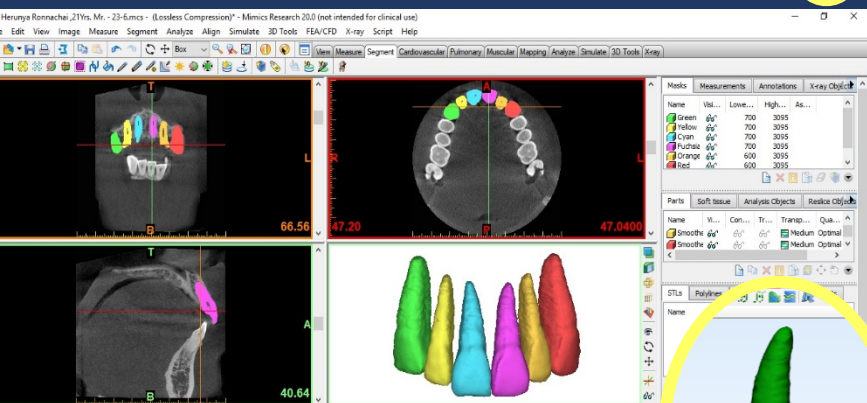


Fig. 1 Digital imaging and Communication in Medicine (DICOM) datasets of the patients are imported into Mimics® Innovation Suite 15.01 and reconstructed

The root surface area of each teeth are calculated using the 3-matic software

Advisor
Suchada Limsirivong
Author

V. Pornatitanakul, S. Boonkasem, S. Nangsue, W. Limsirivong, R. Chuenshod