3 - Dimensional Computed Tomography
A New method for Localization of Impacted Canines

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A new method for localization of canine; the shaded surface display method of 3-D CT imaging is presented. The advantages and indications for using 3-D-CT for localization are also discussed.

The ectopic eruption and impaction of maxillary permanent canines is a frequently encountered clinical problem. The diagnosis of canine impaction is based on clinical as well as radiographic examinations. The proper localization of the impacted tooth plays a crucial role in determining the feasibility as well as the proper access for the surgical approach, the proper direction for the application of orthodontic forces, and the extent of root resorption and damage to the adjacent teeth.

The three commonly used methods of radiographic localization are:
1) The parallax method (image/tube shift; Clark's rule)
2) The use of two radiographs taken at right angles to each other;
3) Stereoscopy.

According to Ericson and Kuroi, with the use of periapical films, the clinician is able to evaluate the position of the canine with sufficient accuracy in 92% of the cases. However, in only 37% of the cases were they able to project the lateral incisor image completely away from the canine.

Resorption on the roots of the maxillary incisors is often difficult to diagnose on intra-oral films or an OPG, especially when the dentine loss is located buccally or lingually. This is primarily due to overlapping of the incisors by the ectopic canine. Even resorptions of the pulp may be overlooked on intra-oral films.

To increase the diagnostic accuracy, conventional polytomography has been used.

However, conventional tomography does not completely blur out all disturbing structures and root resorptions may go undetected. Computed tomography (CT) eliminates the blurring problems of conventional tomography and increases the perceptibility of root resorption substantially. CT has been proven to be most effective in detecting root resorption.

CT is also outstanding for assessing the positions of the teeth and their mutual relationship compared to other diagnostic methods.

However, a disadvantage of CT is the relatively high radiation dose to the patient. Preda et al. reported on the technique of spiral CT with a 1:1 or 2:1 pitch using multiplanar reconstruction. Spiral CT reduces examination time and the risk of accidental movement, without loss of image quality. They concluded that CT should be limited to complex anatomic situations where conventional radiography poorly depicts the actual relationship between the impacted tooth and the roots of adjacent teeth.

A 21 year old female patient reported to the Orthodontic department with the complaint of a retained deciduous left upper canine. She presented with a CL molar relationship, a non-mobile retained deciduous canine and lower incisor crowding. The permanent maxillary canine could not be palpated clinically.

In order to carefully localize the impacted canine and predict the prognosis accurately, it was decided to carry out a spiral CT scan, followed by 3-dimensional reconstruction. An informed consent was obtained from the patient.

Method:

A Siemens Somatome Plus CT – scanner (Siemens AG, Germany) was used for the
tomography. Contiguous transverse and sagittal CT scans with slice thickness of 2 mm were exposed parallel and perpendicular to the maxillary incisors.

3-dimensional reconstruction was done using the GE workstation. The shaded surface display was used in order to assess the relationship of the maxillary canine to the adjacent teeth.

Figure 1 and Figure 2 show the transverse and the sagittal CT slice which reveal that the impacted canine was horizontally impacted and located superior to the premolar roots.

The sagittal 3-D slice revealed that the impacted tooth was angulated with the crown more superiorly positioned than the root.

The biggest advantage of 3-D reconstruction is the ability to generate another image without subjecting the patient to further radiographic examination.

In order to accurately reveal the relation between the roots of the premolars and the impacted canine an oblique and superior 3-D view was generated. It revealed that the impacted canine was positioned away from the roots of the premolars thus eliminating the risk of resorption.

Discusson:

Computed tomography means additional radiation and costs. The probability of stochastic effects, expressed as an equivalent whole body radiation dose (effective dose), in this CT approach increases about 2 to 8 times, compared to conventional full mouth or panoramic radiographs. Root resorption of adjacent teeth is visualized about 50% more often by CT scanning than by intraoral X-rays. Also, CT has been found to be superior.

Fig. 1: Plain axial CT Slice revealing the impacted canine in left anterior maxilla.

Fig. 2: Sagittal CT slice shows the horizontally impacted canine located superior to the premolars.

3-dimensional reconstruction revealed that the impacted canine was horizontally impacted, palatally positioned in relation to the premolar teeth (Figure 3).

Fig. 3: Superior view of maxillary dentition using shaded surface display. Impacted canine located palatal to the premolars.

Fig. 4: Shaded surface display – Sagittal view of maxillary dentition.

Fig. 5: Superior – oblique view of maxillary dentition. Impacted canine positioned away from the roots of adjacent teeth.
to plain-film radiography in showing the multiplanar shape of tooth crown and root, crown-root relationship and tooth inclination. The benefits of accurate diagnosis balances the drawbacks of using CT by providing a better foundation and prognosis for orthodontic treatment.

Summary and Conclusions:
A new technique of impacted canine localization was presented with the aid of a clinical case. 3-dimensional CT, utilizing the shaded surface display method, is a very useful and accurate method. Its use is recommended in cases with complex anatomical situations after a careful risk/benefit analysis.

References: