Localization of impacted maxillary anterior tooth with tangential radiograph

ABSTRACT
An occlusal film placed parallel to the midsagittal plane of the head can be used to locate the bucco-palatal position of the supernumerary teeth. The same principle can also be applied with the central ray directed tangentially to the impacted canine for location of bucco-palatal position. This approach requires minor modification of the radiographic film-holding device and can be employed in all dental office settings. Two cases regarding this technique were also presented.

Key words: Radiography, dental; Tooth, supernumerary

Introduction
The position of the supernumerary teeth in relation to the root of the maxillary anterior teeth is important for determining the surgical approach used for their removal. The prevalence of supernumerary teeth is 1 to 3%. Also, determining the bucco-palatal position of an unerupted and impacted canine (which has a prevalence rate of 2.56%) is essential to enable the orthodontist to formulate the treatment plan.

Principle of parallax
Traditionally, two radiographs of the same region with different angulations are used to localize the position of the unerupted supernumerary teeth or canine. The difference in angulations can be in the horizontal or vertical direction. Clark described a technique where the position of the buried tooth is compared in three periapical radiographs, one central, one mesial, and one distal to the buried tooth. This approach is commonly referred as Clark’s rule and applies the principle of parallax to delineate the spatial relationships of an object. The parallax technique utilizes the apparent displacement of the image of an object relative to the image of a reference object caused by changing the angulation of the X-ray beam. The image of an object that is more distant from the X-ray tube (palatally positioned) moves in the same direction as the tube, whereas the image of an object closer to the X-ray tube (buccally positioned) moves in the opposite direction to the tube. The acronym SLOB (Same Lingual, Opposite Buccal) can help clinicians to remember the principle of tube shift.

Keur used two occlusal films rather than two periapical films for a horizontal tube shift. As occlusal films cover a larger area, the tube can be moved more, resulting in a more distinct shift of images. A larger film may also have a better chance of showing the entire tooth.
Localization with tangential radiograph

With the availability of orthopantomography (OPG), Keur introduced another commonly quoted method using panoramic and occlusal radiographs for vertical tube shift. In radiating the maxillary anterior region with OPG, the source of the radiograph is positioned behind the patient’s head at an angle of -7 degrees to the occlusal plane and the film is in front of the head. When compared with an anterior occlusal radiograph, which is taken at an angle of +60 to 65 degrees to the occlusal plane, the OPG can be interpreted as the central beam with a vertical angle of +7 degrees to the occlusal plane. Even though the OPG and the occlusal radiograph lie in two different planes, the principle of parallax can still apply. Also, because of a greater difference in the vertical angulations, there will be a larger shift of the image, a feature that will facilitate interpretation. If the impacted tooth moves apically relative to the apices of the anterior teeth in the occlusal radiograph (+60 degrees) in comparison with the OPG (+7 degrees), the impacted tooth is lingual (palatal) to the root of the reference tooth. Conversely, if the impacted tooth moves incisally relative to the reference point in the occlusal radiograph when compared with the OPG, the impacted tooth is situated on the buccal aspect of the reference teeth. According to Jacobs, both the positions of the crown and of the root apex should be checked in order to get a full picture of the position of the impacted tooth.

With the advent of computed tomography (CT), the spatial relationship of the impacted teeth in relation to the other anatomical structures can be shown clearly in the 3-dimensional reconstruction images of the CT scan or cone beam CT. However, such equipment is not readily available in a general dental office.

Tangential radiograph

In most clinical situations, the position of the impacted tooth can be ascertained. In doubtful cases, however, we have employed the following technique to confirm the exact location of the buried tooth. The position of the impacted tooth is located by lateral radiographic projection using an occlusal film placed parallel to the midsagittal plane of the head. The occlusal film is mounted on a film holder, which has been modified to allow fitting to the cone head of the radiographic machine (Figure 1a). This setup will ensure that the central beam is perpendicular to the occlusal film to minimize distortion. Since the patient is not required to hold the film, movement leading to film blurring can be avoided (Figure 1b). The intraoral X-ray machine is set at 7 mA, 60 kV, with an exposure time of 0.318 second when using type 1 film. The resultant radiograph is developed in the usual manner. The position of the buried tooth will be well demonstrated in the film. When a supernumerary tooth is situated on the palatal side, its image will be overlapped by the adjacent anterior teeth. However, its position can be confirmed by its absence on the buccal side. The same technique can be utilized to locate the position of an unerupted canine, with the central ray directed tangentially to the canine eminence.

Case reports

In Case 1, the impacted left maxillary canine was shown in OPG (Figure 2a). A radiograph was then taken tangentially to the impacted canine (Figure 2b) showing that it was located buccally. In Case 2, a patient presented with an impacted right maxillary canine and an unerupted supernumerary tooth at the apex of the left central incisor, as shown in OPG (Figure 3). The position of the canine and supernumerary tooth is clearly shown in the tangential radiographs (Figure 4).
Discussion

Since 1910 when Clark introduced the method of employing three radiographs at different horizontal angles for the localization of impacted maxillary anterior teeth, the parallax method has remained the radiographic technique of choice. Keur was credited for advocating the use of occlusal radiographs instead of periapical radiographs. He also introduced the OPG and occlusal radiograph in the vertical tube shift technique. However, in our experience, there are situations when the exact location of the impacted tooth can still be difficult to ascertain with these techniques. In the OPG/occlusal radiograph technique, the plane of the occlusal film is almost perpendicular to the plane of the OPG film. This angulation difference may nullify the change in angulations of the radiographic source. Furthermore, the projection of the structures in an arched maxilla onto a flat plane radiograph will cause magnification differences in the OPG and the occlusal radiographs. This will render interpretation of the shifting of images more difficult. The tangential radiograph can give valuable information for localization as it offers direct visualization in the parasagittal plane, which demonstrates the buccal and palatal relationship of the structures. It is particularly useful in communication with the patient as it can give the actual spatial relationship of the impacted tooth and the adjacent teeth. With minimal modification of any type of film-holding device, such as trimming away part of the plastic ring to allow fitting into the cone head of the radiographic machine, the tangential radiograph can be taken using any intraoral radiographic machine.

References