

Review on Object Localization Techniques in Dental Radiology

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Abstract: The dental radiograph is a two dimensional view for a three dimensional object present in the jaws. Sometimes various objects like supernumery tooth, impacted tooth or foreign bodies present inside the jaws and are hidden from eyes causing problem to patient in the form of pain, swelling and vestibular obliteration. Object localization is a method used to locate the position of tooth or foreign object present inside the jaws. It is a small review on various techniques used in object localization and its use in dentistry.

Keywords: Object localization, radiographs, impacted objects, jaws

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I. Introduction

The discovery of X-rays by Wilhelm Conrad Roentgen on the night of November 8, 1895, had such a profound impact on the entire medical world that it has come to be considered one of the most revolutionary achievements in the history of medical science.^[1] Radiography and radiology are vital to the health care profession, offering many non-invasive radiographic techniques that provide detailed information about what underlies superficial skin. Radiographic findings combined with clinical information enable clinicians to make an accurate diagnosis.^[2] The dental radiograph is a two dimensional view for a three dimensional object present in the jaws and does not depict the buccal lingual relationship, or depth, of an object.^[3] Determining the relative position of pathological lesions in the horizontal plane is essential for adequate diagnosis and treatment planning.^[4] There are times when it is necessary to establish the buccal-lingual position of a structure, such as a foreign object or impacted tooth, within the jaws. Object localization techniques can be used to obtain this three-dimensional information.^[3] Two dimensional image of dental radiograph gives orientation of image in either superior-inferior or antero-posterior (IAOP view) direction or in bucco-lingual view (occlusal).^[5] Object localization techniques are necessary to determine the three dimensional position of the object within jaws.⁵ Indications for object localization are given in:^[3,4,5,6] [Table-1]

II. Methods of localization

The clinician may see the bulge of the unerupted tooth or the object of concern and / or observe the position of the adjacent lateral incisor being influenced by the object of concern. If the object is palatally placed, it may push the roots of the lateral incisors labially and the crown may palatally. If the object is labially placed, it may push the roots of the lateral incisors palatally and the crown moves labially.^[6] Clinician can use palpatory method for localizing the impacted maxillary canines (IMC). Frequently, an IMC can be palpated. However, occasionally the bony canine eminence may be confused with the tooth. The clinician should also manipulate the deciduous canine to determine whether it is mobile or not. If a canine is palpable in an abnormal position or cannot be palpated, radiographs are required for its localization.^[6]

III. Techniques of object localization methods

3.1 Clark's Rule: This method was given by Clark in 1910. It is also known as tube shift technique or mesial shift technique or SLOB rule (same lingual opposite buccal).^[7] This rule works on principle of vertex, which states that when an object is viewed from two different positions, the object appears to move in different directions.^[6,7,8] **a.** Reference radiograph, is the first radiograph taken with usual horizontal angulations. **b.** Second radiograph is taken with a slight change in the horizontal or vertical angulations.^[6,7,8] If in the second radiograph the object appears to move towards the side, the tube is shifted with respect to reference radiograph object, then it is considered to be positioned on the lingual side. If the object in reference radiograph moves in the direction opposite to the tube is shifted with respect to reference radiograph object, then it is considered as positioned on buccal side.^[6,7] [Fig-1,2] Clark's rule have some disadvantages like image distortion, decrease clarity, technique sensitive and Superimposition occurs in maxillary teeth especially molars.

3.2 Buccal object rule: This method was discovered by Richard in 1952.^[6] The relative position of radiograph images of two separate objects changes when the projection angle at which images were made is changed. The image of buccal object moves relatively more to image of lingual object, in the same direction that of x-ray beam is directed. In buccal object rule to locate vertically aligned objects, different horizontal angulations are used while to locate horizontally aligned objects different vertical angulations are used.^[6] Use of buccal object rule in various teeth region is as follows:

- Changing the horizontal angle causes the images of buccal cusps to move horizontally, relative to the lingual cusps, in the same direction in which the x-ray beam is directed. This rule applies only to multicusped teeth.[Fig-3]
- Changing the horizontal angle causes the images of buccal root apices to move horizontally, relative to the lingual root apices, in the same direction in which the x-ray beam is directed. This rule applies to the maxillary molar region.[Fig-4]
- Changing the HA causes the image of the anterior border of the ramus to move horizontally, relative to the mandibular molars, in the same direction in which the x-ray beam is directed. This rule is applicable to the mandibular molar region.Fig-5]

3.3 Right angle technique: In right angle technique two projections of the same object are taken at right angle to each other. In right angle technique, one of the standard intraoral periapical radiograph is taken along with one occlusal radiograph. Intraoral periapical radiograph is exposed using the proper technique and angulations to show the position of the object in a superior inferior and anterior posterior relation and occlusal film is exposed directing the central ray at right angle to the film. The occlusal film shows the object in a bucco- lingual & anterior posterior relation. On each radiograph the object of interest is located in relation with an anatomical landmark which is used as the reference object in both the radiographs.^[6,7] [Fig-6] Right angle technique is useful mainly in mandibular jaw region.^[6,7]

3.4 Radiopaque wires technique: Radiopaque wire technique is useful in edentulous region, when the teeth are not present, radiopaque wires of different shape are placed in a sheet of wax that is moulded over the edentulous areas as a denture base and radiographs made exposed using Clark's rule of object localization.^[6]

3.5 Stereoscopy : Stereoscopic imaging requires the exposure of two films, one for each eye and thus deliver twice amount of radiation to patient. Between exposure, patient is maintained in position, film is changed, the tube is shifted from right eye to left eye position. After processing, the film are viewed with a stereoscope that uses either mirrors or prisms to coordinate the accommodation and convergence of the viewers eye, so that brain can fuse the two images.^[6,9,10] Stereoscopy can be useful in following :

- Location of small intracranial calcifications and multiple foreign bodies.
- Bony pockets in patients with periodontal disease.
- Morphology of temporomandibular joint.
- Root configuration of teeth for endodontic treatment.
- Assessment of bone shape for dental implants.
- Relationship of mandibular canal with unerupted third molar.

IV. Conclusion

Object localization technique is useful in field of dentistry since 1910. Various Object localization methods are useful in endodontics, pedodontics and oral and maxillofacial surgery specialty of dentistry. When accurate determination of the distance between impacted teeth and the dental arch is not of paramount importance, for radiation safety reasons localization method should be performed using parallax method. Despite of various new and modern techniques coming object localization technique is still useful and convenient for patient as well as operator.

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TABLE:

Table-1 Indications of object localization techniques

Indications for object localization techniques	>	Foreign object
	>	Salivary gland stones
	>	Canal positions
	>	Impacted teeth
	>	Root piece/root positions
	>	Restorative material
	>	Broken needle
	>	Superimposition
	>	Jaw fractures

FIGURE:

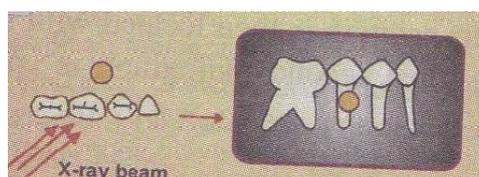


Fig-1 Clark's rule reference radiograph

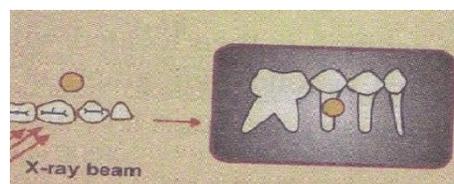


Fig -2 Clark's rule second radiograph

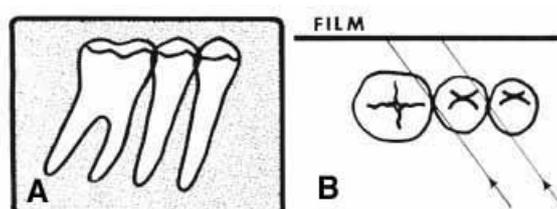


Fig-3 Buccal object rule for bicuspid teeth

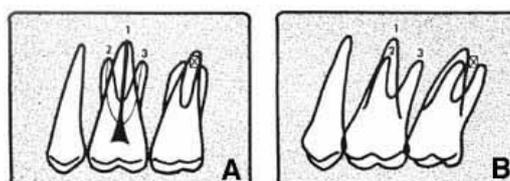


Fig-4 Buccal object rule for maxillary molars

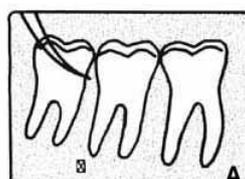


Fig -5 Buccal object rule for mandible molars

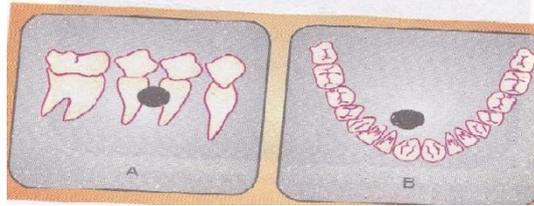


Fig -6 Right angle technique

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