International Journal of Contemporary Dental and Medical Reviews (2021), Article ID 010421, 3 Pages

REVIEW ARTICLE

Object localization technique in dentistry – A review

Lavanya Nanjunda Rao

Oral Physician and Maxillofacial Radiologist, Dental Unit, Aster CMI Hospital, Hebbal, Bengaluru - 560 092, Karnataka, India

Correspondence:
Lavanya Nanjunda Rao, Oral Physician and Maxillofacial Radiologist, Dental Unit, Aster CMI Hospital, Hebbal, Bengaluru - 560 092, Karnataka, India. Phone:+91-8197246101.
E-mail: lavanya.n.prof@gmail.com

Received: 27 January 2021;
Accepted: 25 March 2021

doi: 10.15713/ins.ijcdmr.160

How to cite the article:
Rao LN. Object localization technique in dentistry – A review. Int J Contemp Dent Med Rev, vol.2021, Article ID: 010421.
doi: 10.15713/ins.ijcdmr.160

Abstract

Background: A dental radiograph is a two-dimensional view for a three-dimensional object present in the jaws. Many times diagnosis becomes difficult for a clinician due to the impacted teeth, supernumerary tooth, or foreign objects. These objects can be localized using various techniques using periapical radiograph, orthopantomograph, and advanced imaging techniques. Tube shift technique, right angle technique, magnification method, vertex occlusal method, stereoscopy, panoramic localization, lateral skull, and posteroanterior view are various techniques which have been used to locate objects. It becomes important for every dentist to know about each technique and its indications. There is a scarcity in the literature which reviews various techniques of object localization. Thus, this article reviews various techniques of object localization in dentistry. **Aim:** This study aims to review on various techniques used for object localization in dentistry and its indications. **Conclusion:** Object localization technique is an easy, convenient, cost effective. This article gives an insight regarding various techniques used since past and its applicability in various indications. **Clinical Significance:** Object localization technique can be applied by a dentist in a day-to-day practice, rather exposing the patient to the advanced screening methods.

Keywords: Impacted objects, jaws, object localization, radiographs

Introduction

In the ongoing clinical practice of dentistry, the dentist often encounters various situations, wherein the need for a three-dimensional radiograph arises. These radiographs are used to determine the location of a foreign object or an impacted tooth within the jaw.[1] Historically, this technique is based on the radiographic phenomenon known as the BOMM Rule, which conveys that by varying the vertical angulation of the light source and/or the backdrop, elongation or shortening of the shadows can be illustrated.[2] Various methods are being used to obtain such three-dimensional information. The most earliest and most commonly used method was introduced by Clarke in 1910 which is known as "tube shift method" or the parallax technique.[3] Keur in 1986 described vertical tube shift technique.[4] Chaushu *et al.* described a method using a single panoramic radiograph. Hitchin in 1951 suggested that true occlusal method can be used for object localization when the central beam is parallel to the long axes of the teeth that are to be used as reference points.[5] Another method is magnification method which is based on the principle that when the teeth move farther away from the film, they appear larger compared with the contralateral teeth. After introduction of computed tomography (CT) and cone-beam CT (CBCT), these have been used as an alternative.[6] Various indications of this technique are – (1) To differentiate the anatomical landmarks from the other radiolucent shadows associated with radicular portion of the teeth, (2) to ascertain the labial or lingual position of radicular fractures, perforations, and resorption, (3) to identify root resorption and to locate foreign objects in case of trauma, (4) during periapical surgery, aids in locating various anatomical landmarks in relation to the tooth apex, (5) the hidden apices can be located before the periapical surgery by placing a radiopaque object such as lead foil near the estimated root apex, and (6) determine the size, shape, number, location, and direction of root canals during instrumentation and obturation.[7] Hence, attempt has been made to review the various techniques of object localization technique in dentistry.

Tube Shift Technique

It is also known as buccal object rule, Clark's rule, the same lingual, opposite buccal (SLOB rule), and Walton's projection. In 1909, this technique was described first by Clark. The concept behind this technique is by changing the projection angle, the relative buccal lingual location of objects in the oral cavity can be ascertained. This idea was redefined and expanded on by Richards in 1953, and again in 1980 which included examples and a self-evaluation test to improve the reader's skill.[7] This

is based on the concept that when two objects are placed one behind the other, the one which is placed at the back is hidden by the front. Thus by varying the angulation or the point of view, both the objects can be viewed. In this technique, three radiographs should be made, the conventional radiograph (over the suspected teeth), one from the mesial position and other distal position by varying the angulation of the tube.[3]

Keur introduced two major improvements in the technique: The use of panoramic and occlusal radiographs. He replaced the periapical with occlusal, since occlusal radiograph covers a larger area. The panoramic radiograph is made wherein the tube is positioned behind the patient's head at an angle of −7° to the occlusal plane, and the film is in front of the head. Next, the anterior occlusal radiograph is made at an angle of −55° to the occlusal plane, wherein there is effective difference of 62° between the two radiographs. For example, in the panoramic radiograph, if the image of the cusp tip of the canine is superimposed on the apex of the lateral incisor and if the cusp tip of the canine is superimposed much more coronally in occlusal radiograph, it means that the canine is positioned labially, which corresponds to the SLOB rule.[8] The advantages of this technique are easy availability of intraoral radiography setup in private clinics and remote or rural areas wherein this technique can be easily applied. However, disadvantages of this technique are projection errors and patient's lack of cooperation which might lead to faulty radiographs.

Right Angle Technique

This technique involves use of two radiographs – periapical and occlusal. Initially, periapical radiograph is made to assess the position of the object anteroposteriorly and superior-inferiorly, whereas occlusal radiograph is made to assess the buccolingual relation of the object. Thus by studying the two radiographs, the relative position of the object can be achieved.[9] The advantage of this technique is both anteroposterior and superoinferior positions of the object can be assessed.

The Magnification Method

This is based on the principle that, for a given focal spot-film distance, objects further away from the image receptor will be depicted more magnified than objects closer to the film. For example, on a panoramic radiograph, a palatally impacted canine will appear to be larger than teeth in the dental arch.[4] The advantage of this technique is easy availability panoramic radiograph, however, disadvantage of this technique is radiographic errors might lead to faulty interpretation leading to the misdiagnosis.

The Vertex Occlusal or the True Occlusal Method

In this method, any object that lies near the central incisor shall appear in relation to the long axis of the central incisor. In this radiograph, the central ray passes through the vertex of the skull and exits through the long axis of the central maxillary incisors. The central ray should make an angle 110° to the horizontal and 20° to the vertical. The central incisors appear as "button with holes" in the radiographic image which is obtained. Thus, relative position of any object which lies near central incisor can be obtained.[10] However, his method is technique sensitive and requires a good skill of an examiner.

Stereoscopy

Stereoscopic imaging is made by exposing two films, which deliver twice the amount of radiation to patient. Between the exposure, when position of patient is maintained and film changed, the tube is shifted from the right eye to left eye position. After processing, the film is 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.[9] This method requires the availability of stereoscope and might also lead to observer bias.

Panoramic Localization

Panoramic radiograph can be used to locate foreign objects located in the maxillary and mandibular anterior region. While the distance between the tube and the film remains constant with the fixed position of patient's head, cassette, and X-ray tube, head should be rotated in a clockwise direction of 180° in a fixed arc. Through this, the distal aspect of the patient's left side is projected in the radiographic film. This is because the tube head begins from the right front side when the cassette has placed on the left side. After the tube, head traverses 90° from its start position, the head of the tube should be stopped. During this point, the hemifacial region on the left side and a portion of the right incisor region are captured. Now, the patient should be laterally shifted, wherein the tube head completes the arc of 180°, covering the right side and left incisor region of the patient. The finished radiograph exhibits right and left jaw from condyle to condyle with the blank central area due to radiation emission halt. On either side of this non-exposed area, an image of the incisor region is juxtaposed. These juxtaposed areas enable one to localize in three dimensions. Hence, this overlap provides two views of the same area from two different horizontal angles.[11]

Lateral Skull and PA View

This method which is favored by orthodontists was initially described by Broadway and Gould and was applied into clinical practice by Ballard. This method was widely used before the routine use of panoramic radiograph. Using lateral skull and posteroanterior view, the position of the impacted canine can be assessed in relation to the incisor. The height and the angulation of the impacted canine can also be accurately assessed using this technique.[12] This method is now outdated method since the introduction of panoramic radiograph.

CT Scans

It offer true-to-scale imaging of the dentition without overlying structures but involve higher radiation exposure than panoramic radiographs. According to Frederiksen *et al*., the radiation to which single organs in the vicinity (eye lens and thyroid gland) are exposed is similar to that from a full mouth X-ray. Because of the additional radiation load, higher costs, and more complex procedure, however, CT is not recommended as a screening method.[13] Several authors have used CT particularly spiral CT for localization of the impactions and for evaluation of resorption of incisors, due to the excellent tissue contrast and precise three-dimensional images afforded by this technique.[14] This is one of the advanced imaging modalities which provides three-dimensional information of the object, but cannot be applied in day-to-day practice.

CBCT

It allows the impacted tooth to be correctly localized, which makes the surgical procedure less invasive, more efficient, and quicker. Problems with amplitude and superposition of dental structures, which make radiographic interpretation a particular challenge, are potentially eliminated using this technique. The CBCT provides true and precise anatomical information and appears superior to conventional radiography (intraoral and panoramic), especially in the anterior region of the maxilla, usually with multiple narrow adjacent anatomical structures.[15]

Conclusion

Radiography is yet a boon to the field of medicine, due to which various structures can be studied widely. Object localization is one of the techniques which involves in locating any hidden foreign objects. Hence, the right knowledge regarding which technique to be used is required to every clinician for day-to-day practice.

References

1. White SC, Pharoah MJ. Oral Radiology-E-Book: Principles and Interpretation. Amsterdam: Elsevier Health Sciences; 2014.
2. Chenail B, Aurelio JA, Gerstein H. A model for teaching the buccal object moves most rule. J Endod 1983;9:452-3.
3. Clark CA. A method of ascertaining the relative position of unerupted teeth by means of film radiographs. Proc R Soc Med 1910;3:87-90.
4. Keur JJ. Radiographic localization techniques. Aust Dent J 1986;31:86-90.
5. Hitchin AD. The maxillary canine. Dent Pract Dent Rec 1951;2:100-3.
6. Tsolakis AI, Kalavritinos M, Bitsanis E, Sanoudos M, Benetou V, Alexiou K, *et al*. Reliability of different radiographic methods for the localization of displaced maxillary canines. Am J Orthod Dentofacial Orthop 2018;153:308-14.
7. Goerig CA, Neaverth EJ. A simplified look at the buccal object rule in endodontics. J Endod 1987;13:570-2.
8. Jacobs SG. Radiographic localization of unerupted mandibular anterior teeth. Am J Orthod Dentofacial Orthop 2000;118:432-8.
9. Garg K, Sachdev R, Chauhan S, Mehrotra V, Ishrat S. Review on object localization techniques in dental radiology. IOSR J Dent Med Sci 2018;17:72-5.
10. Chalakkal P, Thomas AM, Akkara F, de Ataide ID. Vertex occlusal radiography in localizing unerupted mesiodentes. J Indian Soc Pedod Prev Dent 2011;29:260-3.
11. Turk MH, Katzenell J. Panoramic localization. Oral Surg Oral Med Oral Pathol 1970;29:212-5.
12. Coupland MA. Localisation of misplaced maxillary canines: Orthopantomograph and PA skull views compared. Br J Orthod 1984;11:27-32.
13. Freisfeld M, Dahl IA, Jäger A, Drescher D, Schüller H. X-ray diagnosis of impacted upper canines in panoramic radiographs and computed tomographs. J Orofac Orthop 1999;60:177-84.
14. Abdel-Salam E, El-Badrawy A, Tawfik AM. Multi-detector dental CT in evaluation of impacted maxillary canine. Egypt J Radiol Nucl Med 2012;43:527-34.
15. Walker L, Enciso R, Mah J. Three-dimensional localization of maxillary canines with cone-beam computed tomography. Am J Orthod Dentofacial Orthop 2005;128:418-23.