Extraoral Periapical Radiography: A Technique Unveiled

Sujatha S Reddy, Atul Kaushik, SriRekha Reddy, Kunal Agarwal

1Professor, Department of Oral Medicine, Diagnosis and Radiology, MS Ramaiah Dental College and Hospital, Bengaluru, Karnataka, India
2Senior Lecturer, Department of Oral Medicine, Diagnosis and Radiology, SGI Dental College and Hospital, Gurgaon, Haryana, India
3Postgraduate Student, Department of Oral Medicine, Diagnosis and Radiology, MS Ramaiah Dental College and Hospital, Bengaluru, Karnataka, India

Correspondence: Sujatha S Reddy, Professor, Department of Oral Medicine, Diagnosis and Radiology, MS Ramaiah Dental College and Hospital, MSRIT Post, New BEL Road, Bengaluru-560054, Karnataka, India, e-mail: s_sujathajanardhan@yahoo.com

ABSTRACT

Introduction: Extraoral periapical radiography (EOPAR) is a technique where the film is placed extraorally overlying the tooth of interest and the X-ray beam is directed from the opposite side of the face. This technique was first proposed by Newman and Friedman (2003) and later modified by Chia-Hui Chen et al (2007) to assist certain patient populations who are unable to tolerate intraoral films/sensors.

Materials and methods: An experimental case study was designed using dry skulls. The modified beam aiming device was assembled and positioned accordingly to the tooth of interest at vertical angulations of – 20 to – 30 for maxillary teeth and + 20 to + 30 for mandibular teeth. The X-ray beam was directed from the opposite side toward the film/sensor placed extraorally on the contralateral side. Once, the exposure parameters were established on dry skulls, the technique was validated on human volunteers.

Results: A series of clinically useful radiographic images of the maxillary and mandibular premolars and molars were obtained using EOPAR radiographic technique.

Conclusion: EOPAR technique can be used to produce diagnostically useful radiographs of the maxillary and mandibular teeth. It is an effective approach for obtaining periapical radiographs in certain patient populations who are unable to tolerate intraoral films and/or sensors. Although this technique is not intended to be a substitute for conventional intraoral radiography, it is a useful supplement to our clinical practice.

Keywords: Extraoral radiographic technique, Periapical radiograph, Beam aiming device, Exaggerated gag reflex, Dental phobia.

INTRODUCTION

Intraoral periapical (IOPA) radiographs form the backbone of imaging for tooth and the periodontium for the general dentist. IOPA radiographs are usually the initial radiographs advised for diagnosis and follow-up of various dentofacial pathologies. The main indications for periapical radiography include detection of periapical infection/inflammation, assessment of the periodontal status, tooth and dentoalveolar fractures, to assess the presence and position of unerupted teeth, assessment of root morphology during endodontic procedures, preoperative assessment and postoperative appraisal of apical surgery and evaluation of implants postoperatively.¹

However, certain patient populations unable to tolerate intraoral films/sensors due to various reasons, an alternative technique of EOPAR was attempted by Newman and Friedman in 2003.² They reported that patients tolerated the procedure well, preferring the extraoral technique to conventional intraoral periapical radiography (IOPAR). Later, Chia-Hui Chen et al in 2007 devised a film/sensor beam aiming device for the EOPAR technique to align the X-ray beam directly at the film/sensor under the guidance of the locator ring to avoid cone cuts.³

Panoramic radiograph may overcome some of the limitations of IOPAR, but has certain disadvantages, like higher radiation dose, greater cost, image magnification, reduced image resolution and limited availability in the dental offices.¹

Hence, in this present study, we have attempted to develop an improved beam aiming device to capture diagnostically acceptable periapical images using EOPAR technique.

MATERIALS AND METHODS

This study was carried out in the dental radiology department using the ‘EXPLOR-X 70’ Dental X-ray unit (Confident Dental Equipments, India); 70 kVp, 8 mA, 2 mm aluminum filtration, 60 mm beam diameter and Kodak E-speed films number 2 (Eastman Kodak Co., France, 31 × 41 mm). It was initially tried on dry skulls with full complement of upper and lower teeth. Once, the exposure parameters were standardized on dry skulls, the technique was adapted on patients. The film/sensor holder or beam aiming device was prepared using an acrylic tube of about 2 inches, two locator rings, two metal supporting indicator rods and a bite block used in bite-wing radiography (Fig. 1A).
Procedure for Assembling the Aiming Device

The two supporting metal indicator rods were inserted into the two locator rings (Rinn, Dentsply, York, PA) one at each end. At one end of the indicator rods, the bite block was attached and then the film/sensor was placed into the slot of the bite block. Care was taken so that the exposing surface of the film/sensor was oriented in the direction of the X-ray cone. The two indicator rods were then connected together using the acrylic tube made by cold-cure acrylic used for various prosthetic purposes (Fig. 1B). The purpose of using an acrylic tube instead of a rubber tube as prepared by Chia-Hui Chen et al was to provide a more rigid and stable support, and moreover the acrylic tube has slots for the rods to easily slide which allow the locator rings to be placed as per the individual requirements.

METHODOLOGY

Initially, dry skulls with full complement of upper and lower teeth were used for the study to standardize the exposure parameters. Maximal mouth opening was achieved in the dry skulls using bite blocks in the anterior region and the beam aiming device was positioned. The exposure parameters observed for radiographing maxillary premolars and molars have been discussed in Table 1A. Once the exposure parameters were standardized on dry skulls, the study was validated on human volunteers. Informed consent was taken from all the volunteers and the aim and methodology of the study was explained to all volunteers.

Table 1A: Various parameters for radiographing maxillary premolars and molars using EOPAR technique

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Maxillary premolars</th>
<th>Maxillary molars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placement of the radiographic film/sensor on</td>
<td>Parallel to the maxillary premolars, such that the tooth of interest comes in the</td>
<td>Parallel to the maxillary molars, such that the tooth of interest comes in the</td>
</tr>
<tr>
<td>the bite block</td>
<td>center of film/sensor</td>
<td>center of film/sensor</td>
</tr>
<tr>
<td>Projection of the central ray</td>
<td>Position the holding instrument so that the beam is directed through the opposite</td>
<td>Position the holding instrument so that the beam is directed through the opposite</td>
</tr>
<tr>
<td></td>
<td>side buccal soft tissue without exposing the crowns of opposite side teeth</td>
<td>side buccal soft tissue without exposing the crowns of opposite side teeth</td>
</tr>
<tr>
<td>Vertical angulation</td>
<td>– 20 to – 30 degrees</td>
<td>– 20 to – 30 degrees</td>
</tr>
</tbody>
</table>
Table 1B: Various parameters for radiographing mandibular premolars and molars using EOPAR technique

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Mandibular premolars</th>
<th>Mandibular molars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placement of the radiographic film/sensor on the bite block</td>
<td>Parallel to the mandibular premolars, such that the tooth of interest comes in the center of film/sensor</td>
<td>Parallel to the mandibular molars, such that the tooth of interest comes in the center of film/sensor</td>
</tr>
<tr>
<td>Projection of the central ray</td>
<td>Position the holding instrument so that the beam is directed through the opposite side buccal soft tissue without exposing the crowns of opposite side teeth</td>
<td>Position the holding instrument so that the beam is directed through the opposite side buccal soft tissue without exposing the crowns of opposite side teeth</td>
</tr>
<tr>
<td>Vertical angulation</td>
<td>+ 20 to + 30 degrees</td>
<td>+ 20 to + 30 degrees</td>
</tr>
</tbody>
</table>

Fig. 2A: Positioning of beam aiming device for radiographing maxillary premolars and molars

Fig. 2B: First schematic representation of the same

Fig. 3A: Positioning of beam aiming device for radiographing mandibular premolars and molars

Fig. 3B: Second schematic representation of the same

Fig. 4A: EOPA radiograph in relation to 14, 15, 16 and 17

Fig. 4B: EOPA radiograph in relation to 44, 45 and 46
the film/sensor under the guidance of the locator ring. The film/sensor device which was prepared in our department was an inexpensive one, assembled using the various components of RINN X-ray holder, like locator rings, metal indicator rods and bite block, which are available in most of the dental clinics. The acrylic tube can also be easily prepared using the self-cure acrylic.

EOPAR technique allows the clinician to obtain diagnostically acceptable periapical radiographs in patients who are unable to tolerate placement of intraoral films/sensors. Some patients have problems with the placement of digital intraoral sensors which are much larger and rigid, adding to the bulk compared to the standard radiographic films which are smaller and flexible. In such individuals EOPAR can be used. Fisher in 1974 obtained 3rd molar images on occlusal film using EOPAR technique, but the drawback was the requisite high kVp (as high as 90 kVp) and hence had limited application. In our study 70 kVp was used for all EOPA radiographs. The resultant radiographs of upper and lower posterior teeth were of good diagnostic quality, though there was a slight reduction in the resolution of the resultant images. The EOPAR technique is patient friendly, easy to perform and the resultant radiographs are diagnostically acceptable. This technique also reduces chances of cross infection between patient and clinician as there is no saliva contamination of the film/sensor.

Limitation of this technique is a slight increase in the radiation dose to the patient to compensate the increased distance between X-ray source and film/sensor which can be negated by the reduction in the number of unacceptable films taken intraorally in these patients. Moreover, the radiation dose is much less compared to panoramic radiographs usually advised for these groups of patients. EOPA radiographs have lesser resolution and contrast compared to IOPAR radiographs. It cannot be performed on anterior maxillary and mandibular teeth due to curvature of the arch and difficulty in positioning of the X-ray cone and it is technique sensitive.

CONCLUSION

EOPA radiography is an effective approach for obtaining periapical radiographs in certain patient population groups who are unable to tolerate IOPA radiography. Although this technique is not intended to be a substitute for conventional intraoral radiography, it is a useful supplement to our clinical practice.

ACKNOWLEDGMENT

We would like to acknowledge our Principal and Professor Dr HN Shama Rao and Head of Department and Professor Dr Yashoda Devi BK for their guidance and support.

There are no competing conflict of interests existing with the manuscript.

REFERENCES