

# A Novel 20° X-ray Angle Shifter for Superimposed Canal Separation

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## ABSTRACT

**Aim and objective:** The purpose of this study was to evaluate the efficacy and frequency of a 20° angle Shifter in separating superimposed canals on multirrooted tooth radiographs.

**Materials and methods:** Radiographs from patients with 38, 44, and 39 of two-canal maxillary premolars, three- and four-canal mandibular molars, respectively, were taken at a horizontal 20° mesial and distal shift using the Shifter. The radiographs were evaluated by two examiners using the PowerPoint program. The percentage of distinctly separated canals in both shifted radiographs was analyzed using the Chi-square test ( $p = 0.05$ ). The strength of agreement between each examiner (intra and inter) was evaluated using kappa statistics ( $p < 0.05$ ).

**Results:** The percentage of acceptable radiographs using the mesial and distal shift for both examiners was similar for maxillary premolars. However, the distal and mesial shift was superior compared with the mesial and distal shift in separating the root canals in three- and four-canal mandibular molars, respectively. The strength of agreement between examiners evaluated using kappa statistics ( $p < 0.05$ ) was substantial-almost perfect.

**Conclusion:** The Shifter efficiently separates superimposed canals. The advantage of the Shifter is the precise radiograph angle taken and at the same position during the multiple steps requiring radiographs in endodontic treatment.

**Clinical significance:** The same position of the tooth on the multiple-step radiographs in endodontics is the benefit of this novel shifter.

**Keywords:** 20° angle, Canal separation, Radiograph.

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## INTRODUCTION

Radiographic evaluation is important in most root canal treatment steps, beginning from measuring the working length to determining the accurate root canal length for cleaning and shaping the canals through the final root canal filling. An accurate working length prevents pushing the instruments, debris or necrotic tissues, or irrigant into the apical tissue as well as determining the end position of the root canal filling material, which affects the long-term success rate of root canal treatment.<sup>1,2</sup> Currently, endodontists typically use an electronic apex locator (EAL) for measuring the root canal length to determine the working length.<sup>3</sup> However, in some cases, a radiograph is still used for working length determination before continuing root canal treatment. The disadvantage of using a periapical radiograph is that the three-dimensional tooth is represented on a two-dimensional film. The depth of the buccolingual aspect of the tooth cannot be shown on a radiograph, especially for mandibular molars and maxillary premolars that have superimposed roots.

Gulabivala et al.<sup>4</sup> revealed that 61% of first mandibular molars have three canals and 31% have four canals. Moreover, 58 and 17% of secondary mandibular molars have three canals and four canals, respectively. Approximately 70% of maxillary first premolars have two canals; 29% have one canal, and only 1% have three canals. In maxillary second premolars, the incidence of one canal is 82% and of two canals is 18%.<sup>5</sup> Thus, there is a high chance that a periapical radiograph of these teeth would have superimposed canals that are not sufficiently diagnostic for use in endodontic treatment.

To generate a high-quality radiograph with separated root canals, shifting the X-ray tube on the horizontal plane in the mesial or distal direction is usually used based on the buccal object rule,<sup>6</sup>

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which refers to when the position of the X-ray tube is moved mesially to the tooth. The radiograph was taken in this manner then shows the separated root canals in which the lingual canal is always closer than the buccal canal. Due to this phenomenon, the buccal object rule can be also interpreted as SLOB or the same lingual opposite buccal.

Radiographs taken where the X-ray is perpendicular to the film are less effective in separating superimposed root canals compared with those taken using a 20° horizontal mesial or distal