Efficacy of Radiographic Positioning Devices for Bitewings in the Operating Room

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Introduction

Bitewing radiographs are an essential diagnostic tool for the diagnosis of interproximal dental caries, as well as the assessment of the posterior dentition and alveolar bone. Comprehensive dental treatment under general anesthesia, including radiographic examination, is a common treatment modality used amongst pediatric dentists for patients who are young, uncooperative, have anatomical variations, trauma, facial cellulitis, medical risk, or special health care needs.[1] This study aims to address the suspected perception that pediatric dentists believe orotracheal tubes may compromise x-ray quality.[2] In accordance with the FDA/ADA guidelines the AAPD advocates for adherence to the as low as reasonably achievable (ALARA) principle.[3] The APPD recommends the following to comply with the ALARA principle: 1) use of the fastest image receptor compatible with the diagnostic task and use of a receptor with a beam-guiding device; 2) use of rectangular collimation, collimation of the beam to the size of the receptor, and use of a long-positioning indicating device; 3) appropriate operating potentials and proper film exposure and processing techniques; and 4) limiting the number of images to the minimum necessary to obtain essential diagnostic information.[3] This study focuses on the specific AAPD recommendations of using a beam-guiding device and its impact on successfully limiting the number of images obtained. Pre-existing studies report clinician use of extraoral X-ray position devices only 37-60% of the time.[4]

Purpose

This study compares bitewing radiograph quality in orally intubated patients using three positioning devices. The results of the study will help determine if the frequences of clinical retakes in the operating room can be reduced with extraoral positioning devices.

Hypothesis

Extraoral positioning devices will improve diagnostic quality of bitewing radiographs, subsequently reducing image re-takes in orally intubated patients in the operating room setting.

Material & Methods

Figure 1. REDLAND autoclavable digital bitewing sensor holder.

Figure 2. DEXIS PositionIT digital sensor holder.

Figure 3. XCP-ORA® One Ring & Arm Positioning System and DEXIS Nomad rectangular collimator attachment.

Figure 4. Rinn DXTTR with endotracheal tube in oral cavity.

A Rinn DXTTR was affixed to a supine dental chair, and an endotracheal tube was placed in the oral cavity and taped to the right commissure. Bitewings were captured using an autoclavable digital bitewing sensor holder, a DEXIS PositionIT digital sensor holder, and an XCP-ORA® One Ring & Arm Positioning System and DEXIS Nomad rectangular collimator attachment. Radiographs were taken using a handheld Nomad with the shield extended fully forward, and all extraoral rings were positioned at the end of the arm. All radiographs were obtained by a single operator who was instructed to capture pre-molar bitewings including the distal of the canines. These instructions were given to simulate the pediatric dentition (C's, D's, and E's). The radiographer was blinded from seeing any resulting images until the data collection phase was completed. Radiographs were assessed for presence of overlap and the distal surface of canines. The data was analyzed using un-paired T-Tests.

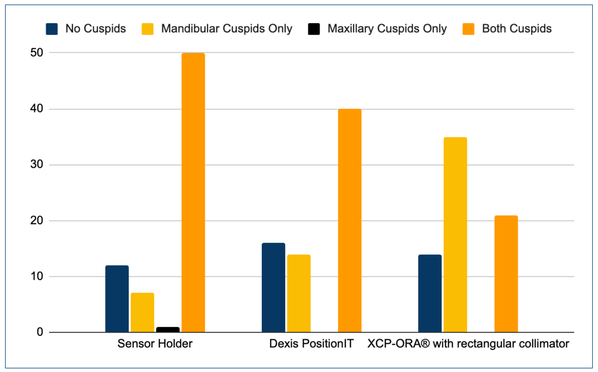

Figure 5. Number of X-rays in each scoring category (0-3) for evaluation of canines visible.

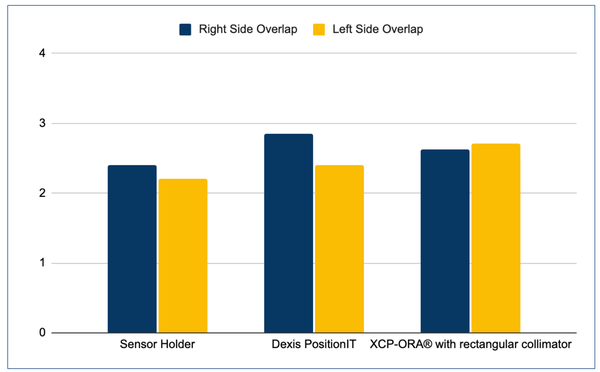

Figure 6. Average of right and left side bitewings scored 0-4 for number of overlap-free primary spaces.

Bitewing Scoring Methods:

- Conecut: Judged on presence or absence of a conecut impairing diagnostics
- Primary Contacts: Scored 0-4 with one point awarded for every overlap-free contact between primary teeth per side (Maxillary and Mandibular C-D and D-E space).
- Canines Captured: Judged on the presence of the distal surface of canines per side; 0= No canines, 1= Mandibular only, 2= Maxillary only, 3= both

Results

105 right and 105 left bitewings were obtained. There were no incidences of conecuts compromising the diagnostics of any radiograph. There was a significant finding that the extraoral positioning devices were more successful at reducing overlap of primary spaces (DEXIS PositionIT: P<.05; XCP-ORA® system and rectangular collimator: P<.05). The digital bitewing sensor holder and DEXIS PositionIT were significantly better at capturing the distal of the canines compared to the XCP-ORA® system and rectangular collimator (P<.05; P<.05), and there was no significant difference between the digital bitewing sensor holder and the DEXIS PositionIT (P>.05). There was no significant difference found when comparing the quality of right versus left bitewings (Overlap: P>.05; distal surfaces of canines: P>.05).

Discussion

This study finds both extra-oral positional devices reduced the incidence of overlap between primary tooth contacts, improving the diagnostic quality of the images obtained. This supports the AAPD's recommendation for the routine use of beam-guiding devices. The AAPD also recommends routine use of rectangular collimation, however this study found a statistically significant reduction in image quality with the use of rectangular collimation as the distal surfaces of the primary canines were captured less frequently compared to round collimation. This finding suggests rectangular collimation compromises the limitation of number of x-rays obtained as re-takes may be required to evaluate the C-D space. Endotracheal intubation did not affect bitewing quality as there was no significant difference found when comparing the quality of right (tube side) versus left bitewings.

Conclusion

- Extraoral positioning devices produced higher quality bitewing radiographs by reducing overlap in the simulated pediatric dentition
- The endotracheal tube position did not reduce the quality of bitewing radiographs.

References:

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