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Detecting Caries With and Without the Use of Bitewing Radiographs

Eric A. Reitmeyer, DMD[1] – Sharon Freudenberger, DDS[1] – Shuying Jiang, MS[2] – R. Glenn Rosivack, DMD, MS[1]

[1]Rutgers School of Dental Medicine, Department of Pediatric Dentistry & Community Health, [2]Office of Academic Affairs Newark, New Jersey

Introduction

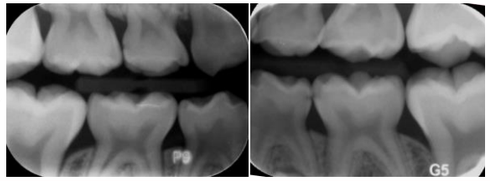
Clinical examinations using visual-tactile techniques have demonstrated tremendous success in detecting occlusal caries. Interproximal lesions, however, are often overlooked following clinical inspection alone. The use of bitewing radiographs in addition to a clinical examination is a well-established technique used in dentistry to accurately diagnose interproximal lesions. While the importance of bitewing radiographs is understood by most dental providers and utilized in clinical practice, many factors influence whether these images are obtained. For example, a patient with clinically sound dentition and a low caries risk does not need radiographs exposed at every recall visit. Other factors, however, can hinder the exposure of radiographs when they are in fact recommended by dental providers. Patient refusal due to radiation exposure, limited coverage by insurance companies, and uncooperative behavior can prevent the exposure of necessary radiographs. With regards to patients with special health care needs, important treatment planning decisions are usually based solely on clinical examination if patients cannot tolerate the exposure of radiographs. If no clinical decay is detected, most dental providers perform preventative measures alone. In these types of cases, most providers do not recommend treatment in the hospital setting due to the risks involved with general anesthesia. Without proper imaging, however, patients can be incorrectly diagnosed as being caries free. The goal of this study is to identify the number of lesions that would go undiagnosed if bitewings radiographs were not exposed. Results can be used to support, modify, or help establish evidence-based radiographic protocols to aid in diagnostic techniques and treatment planning decisions.

Materials & Methods

This study consisted of new or existing patients presenting to the Department of Pediatric Dentistry at RSDM for either comprehensive or periodic dental examinations. The sample population included 172 children ages 6 – 12. Inclusion criteria included patients at least 6 years of age but younger than 13, patients requiring bitewing radiographs at their scheduled appointment as per clinical guidelines, and patients with fully erupted first permanent molars. Exclusion criteria included patients who did not meet inclusion criteria as well as patients with special needs or genetic anomalies affecting the dentition. IRB approval was obtained for this study from the Rutgers Biomedical and Health Sciences Regulatory Oversight (Study ID: Pro2023000229). Clinical and radiographic examinations were completed by 2 calibrated examiners. To test inter-rater reliability, a kappa analysis was performed. For examiners to be considered calibrated, a value of greater than or equal to 0.90 was required for both types of examination. For this study, only posterior teeth (primary or permanent) were examined for caries. For each tooth, five surfaces (occlusal, mesial, distal, buccal, and lingual) were inspected for the presence or absence of decay. Surfaces with decay found during a clinical examination were documented by examiners. Only after completion of a clinical examination, bitewing radiographs were exposed utilizing either an XCP-DS or Snap-A-Ray-DS. Surfaces with decay found radiographically were documented by examiners. All data was de-identified and kept secure. Statistical analysis was used to determine the number of carious lesions diagnosed from clinical examination alone compared to the number of carious lesions diagnosed from the combination of clinical examination and radiographic examination.

Figures & Tables

Figure 1: Bitewing radiographs providing an example of interproximal carious lesions that went undetected following a clinical exam and were only diagnosed after radiographic imaging. (#B-distal, #K-mesial, #L-distal)



Correlations

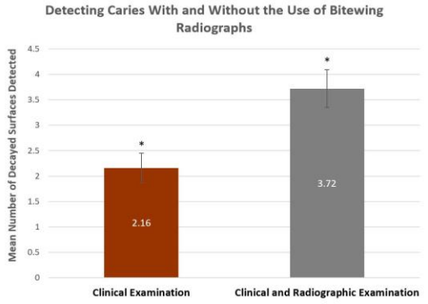
		Clinical decay surfaces- #	Radio + Clinical decay #
Clinical decay surfaces- #	Pearson Correlation	1	.897**
	Sig. (2-tailed)		<.001
	N	172	172
Radio + Clinical decay #	Pearson Correlation	.897**	1
	Sig. (2-tailed)	<.001	
	N	172	172

Table 1: Results show a Pearson correlation coefficient of 0.897 (P < 0.001) indicating a strong positive correlation between variables.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Clinical decay surfaces- #	2.16	172	3.837	.293
	Radio + Clinical decay #	3.72	172	4.872	.371

Table 2, Figure 2 : Results of a Paired Sample T-Test showing the mean number of carious lesions detected from clinical examination alone compared to the number of lesions detected from radiographic examination in addition to clinical examination (P < 0.001).



Results

- A Pearson correlation coefficient (r) of 0.897 indicating a strong positive correlation between variables (Table 2) (P < 0.001). As the number of decayed surfaces found clinically increases, an even greater number of decayed surfaces found through both clinical and radiographic examinations is expected.
- A Paired Sample T-Test was used to compare the mean number of decayed surfaces detected between clinical examination and radiographic examination in addition to clinical examination (Table 2, Figure 2). The difference between the means for each variable (2.16 for clinical, 3.72 for clinical and radiographic) was statistically significant (P < 0.001). In terms of the magnitude of the difference, One-Sample Statistics revealed the difference between the means of each variable to be 1.6. For the average patient involved in this study, an additional 1.6 surfaces of decay could be identified after radiographic examination.
- Of the 172 patients involved in this study, 89 patients had no signs of decay following clinical examination alone. Out of these 89 patients, 29 had carious lesions detected after radiographic examination. Without bitewing radiographs, 32.5% of patients would be misdiagnosed as being caries free (false negatives).

Conclusions

- Patients that present with occlusal caries have a higher probability of possessing interproximal decay.
- Bitewing radiographs proved to be critical in diagnosing interproximal decay. Without radiographs, a high percentage of patients can be misdiagnosed as being caries free. As a result, appropriate and timely treatment may be delayed leading to future pain, infection, and higher costs of treatment.
- This study supports the use of bitewing radiographs to detect interproximal decay on posterior teeth with a frequency of exposure based on an individual's unique caries risk assessment.
- Evidence-based radiographic guidelines must be established to appropriately treat patients with special health care needs. In certain cases, a lack of clinically detectable caries should not deter dental providers from recommending treatment in the hospital setting under general anesthesia. Providers must explain the importance of obtaining radiographs to detect and treat carious lesions while discussing the risks and benefits of receiving treatment in the hospital setting.
- Further research is needed to approximate the number of carious lesions that go undetected after clinical examinations alone performed on patients with special health care needs. Continued research can help establish guidelines to help dental providers determine when initial and subsequent treatment in the hospital setting under general anesthesia is warranted.

References

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Acknowledgements

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