Diagnosis of approximal carious lesions with Digital and Analogue imaging systems

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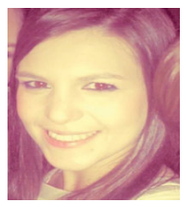

Introduction

Studies about intra-oral radiographies tend to use bitewing for approximal caries detection rather than for occlusal lesions.

Materials and Methods

Observational cross-sectional trial, approved by Ethics Committee; 45 adult patients, who voluntarily attended FHS-UFP operative dentistry appointment. Data from patient's files were collect. Visual observation of bitewings, made during appointments, with PSP (13 patients) and film (32 patients), was performed by 5 examiners (categorized in 3 groups according time of clinical practice (CP): One dentist (D)≥15years; 3D with 10-15years; One D<5years), to detect approximal caries in 1800 surfaces. ICDAS criteria were applied for caries registration. "Dentist≥15 years" was defined as reference/control for calibration. The inter-examiner diagnosis comparison was done with intra-class correlation coefficient/ICC; Statistical analysis performed with α=0.05.

Objectives

To compare the approximal caries diagnosis by different examiners, in posterior teeth, using bitewings, digital (photostimulable phosphor/PSP) and analogue (film) imaging systems.

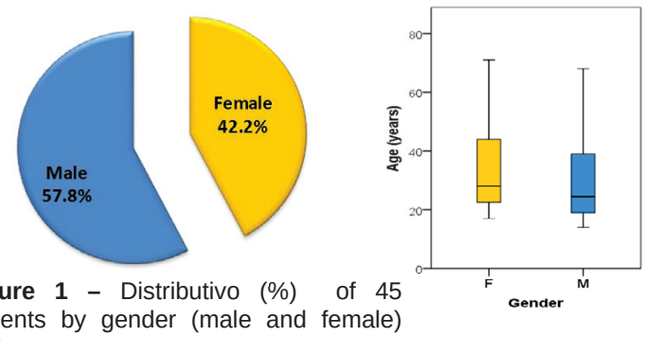

Figure 1 – Distributivo (%) of 45 patients by gender (male and female) and age.

RESULTS

Table 1 – Approximal (mesial and distal surfaces) carious lesions (n, %) in enamel and dentin, according to ICDAS registration, detected by the five examiners with both imaging systems (PSP and film).

Scale to approximal caries (ICDAS Criteria) detection with Both Imaging Systems (PSP/Film)	Mesial Dental Surface	Distal Dental Surface	Both approximal surfaces
Surface Sound	438 (48.67%)	421 (46.78%)	859 (47.72%)
Enamel Surfaces			
01-First Visual Change in Enamel	33 (3.67%)	39 (4.33%)	72 (4.00%)
02- Distinct Visual Change in Enamel			
03- Localized Enamel Breakdown			
Dentin surfaces			
04- Underlying Shadow in Dentin	47 (5.22%)	47 (5.22%)	94 (5.22%)
05- Distinct Cavity with Visible Dentin			
06- Extensive Distinct Cavity with Visible Dentin			
Enamel + dentin surfaces (01+02+03+04+05+06)	80 (8.89%)	86 (9.56%)	166 (9.22%)

Table 2 - Approximal (mesial and distal surfaces) carious lesions detection (n, %) in enamel and dentin, using **PSP, a digital imaging system.**

Scale to approximal caries (ICDAS Criteria) detection with BW radiographs (PSP)	Mesial Surface	Distal Surface	Both approximal surfaces
Surface Sound	128 (49.04%)	134 (51.54%)	262 (50.29%)
Enamel Surfaces			
01-First Visual Change in Enamel	12 (4.6%)	14 (5.38%)	26 (4.99%)
02- Distinct Visual Change in Enamel			
03- Localized Enamel Breakdown			
Dentin surfaces			
04- Underlying Shadow in Dentin	16 (6.13%)	10 (3.85%)	26 (4.99%)
05- Distinct Cavity with Visible Dentin			
06- Extensive Distinct Cavity with Visible Dentin			
Enamel + dentin (01+02+03+04+05+06)	28 (10.73%)	24 (9.23%)	52 (9.98%)

Table 3- Approximal (mesial and distal surfaces) carious lesions detection (n, %) in enamel and dentin, using **film, a analogue imaging system.**

Scale to approximal caries (ICDAS Criteria) detection with BW radiographs (Film)	Mesial Surface	Distal Surface	Both approximal surfaces
Surface Sound	310 (48.51%)	287 (44.84%)	597 (46.68%)
Enamel Surfaces			
01-First Visual Change in Enamel	21 (3.29%)	25 (3.91%)	46 (3.6%)
02- Distinct Visual Change in Enamel			
03- Localized Enamel Breakdown			
Dentin surfaces			
04- Underlying Shadow in Dentin	31 (4.85%)	37 (5.78%)	68 (5.32%)
05- Distinct Cavity with Visible Dentin			
06- Extensive Distinct Cavity with Visible Dentin			
Enamel + dentin (01+02+03+04+05+06)	52 (8.14%)	62 (9.69%)	114 (8.91%)

In this trial 1025 surfaces were registered (Table 1); Sound surfaces: 859 (47.72%); Approximal caries detected: 166 (9.22%); 94 (5.22%) in dentin and 72 (4.00%) in enamel tissues, according to ICDAS registration, by five examiners with both (digital and analogue) imaging systems. Approximal detected with PSP: 52(9.98%); 26(4.99%) in dentin and in enamel tissues (Table 2); Mesial/Distal Caries lesions detected with film:114 (8.91%); 68 (5.32%) in dentin and 46 (3.6%) in enamel tissues (Table 3).

Table 4- Approximal (mesial/distal) carious lesions detection according to categorized 3 groups of examiners ICC by digital/analogue imaging systems analysis.

Bitewing radiographies	Surface	Examiners	ICC	95% IC for ICC	p
Both PSP and Film	Distal+Mesial	All examinors	0.947	0.941 - 0.952	<0.001
		D>15 years vs. MD10-15years	0.950	0.944 - 0.955	
		D>15years vs. MD <5 years	**0.900**	0.888 - 0.910	
		D10-15 years vs. MD<5 years	**0.913**	0.903 - 0.922	
	Distal	All examinors	0.954	0.948 - 0.960	
	Mesial	All examinors	0.939	0.931 - 0.947	
	Distal	D>15 years vs. MD10-15years	0.958	0.951 - 0.964	
	Mesial	D>15 years vs. MD10-15years	0.943	0.933 - 0.951	
	Distal	D>15years vs. MD <5 years	**0.906**	0.890 - 0.920	
	Mesial	D>15years vs. MD <5 years	**0.893**	0.875 - 0.909	
	Distal	D10-15 years vs. MD<5 years	**0.930**	0.919 - 0.940	
	Mesial	D10-15 years vs. MD<5 years	**0.896**	0.879 - 0.911	
	PSP	All examinors	0.948	0.939 - 0.957	
	Film	All examinors	0.946	0.939 - 0.952	
	PSP	D>15 years vs. MD10-15years	0.973	0.967 - 0.978	
	Film	D>15 years vs. MD10-15years	0.937	0.928 - 0.945	
	PSP	D>15years vs. MD <5 years	**0.886**	0.861 - 0.906	
	Film	D>15years vs. MD <5 years	**0.907**	0.893 - 0.918	
	PSP	D10-15 years vs. MD<5 years	**0.909**	0.890 - 0.925	
	Film	D10-15 years vs. MD<5 years	**0.915**	0.903 - 0.925	
PSP	Distal	All examinors	0.960	0.949 - 0.969	
	Mesial	All examinors	0.937	0.920 - 0.951	
Film	Distal	All examinors	0.951	0.943 - 0.959	
	Mesial	All examinors	0.941	0.930 - 0.950	
PSP	Distal	D>15 years vs. MD10-15years	0.969	0.959 - 0.976	
	Mesial	D>15 years vs. MD10-15years	0.978	0.971 - 0.983	
Film	Distal	D>15 years vs. MD10-15years	0.951	0.941 - 0.960	
	Mesial	D>15 years vs. MD10-15years	0.924	0.908 - 0.937	
PSP	Distal	D>15years vs. MD <5 years	**0.906**	0.877 - 0.929	
	Mesial	D>15years vs. MD <5 years	**0.866**	0.823 - 0.898	
Film	Distal	D>15years vs. MD <5 years	**0.906**	0.887 - 0.922	
	Mesial	D>15years vs. MD <5 years	**0.907**	0.888 - 0.923	
PSP	Distal	D10-15 years vs. MD<5 years	0.937	0.917 - 0.952	
	Mesial	D10-15 years vs. MD<5 years	0.882	0.846 - 0.910	
Film	Distal	D10-15 years vs. MD<5 years	0.927	0.912 - 0.939	
	Mesial	D10-15 years vs. MD<5 years	0.903	0.883 - 0.919	

Very high to high agreement values (ICC: 0.866-0.978) were obtained (Table 4); Examiners with less CP showed agreement levels significantly smaller for both imaging systems. More trials are needed to evaluate and compare the diagnosis performance and calibration of examiners, when using different x-ray detectors.

Conclusions: Diagnosis of approximal caries, using X-ray detectors, show an inter-examiner agreement high but differences were detected for the examiners according to image systems (PSP/film) used;

Clinical Implications Approximal caries detection can be better detected using bitewing, with imaging systems that should produce maximum diagnostic information minimizing patient x-ray dose.

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Keywords
Intra-oral radiography
digital radiograph
film
analogue radiography
carious lesions detection diagnosis
photostimulable phosphor (PSP)
bitewing radiography