Radiographic Diagnosis of Dental Caries

S. Brent Dove, DDS, MS

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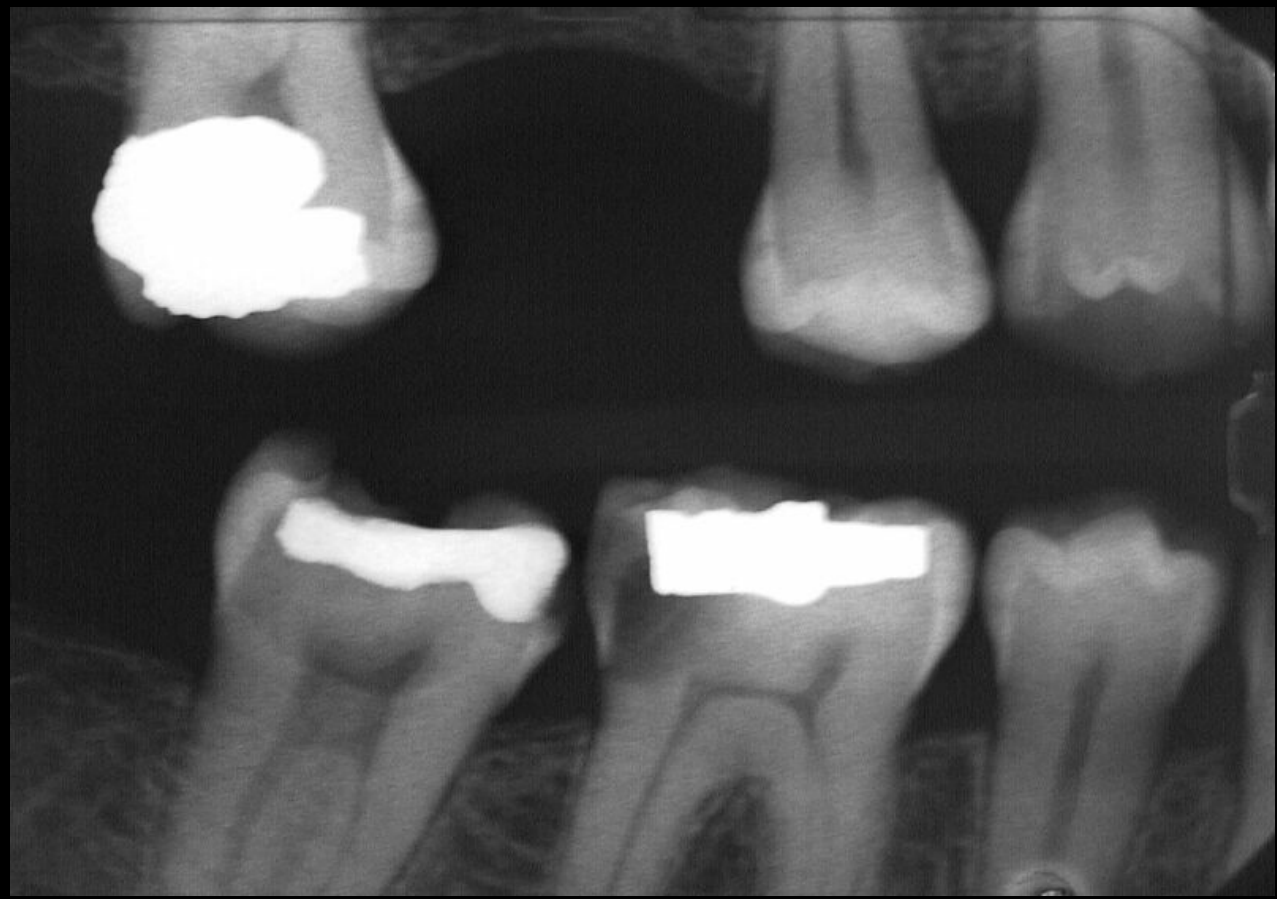
Radiography of Dental Caries



Diagnostic Value of Radiographs

- Creanor, SL, *et al*. 1990
  Br Dent J 169:126-129
- Weerheijm, KL, *et al*. 1992
  Caries Res 26:305-309
- Kidd, EAM, *et al*. 1992
  Caries Res 26:397-401
- Stephen, KW, *et al*. 1987
  Community Dent Oral Epidemiol 15:90-94
- de Vries, HCB, *et al*. 1990
  Caries Res 24:364-370

Literature Search

- Medline, EMBASE, Cochrane Library
- 1966 – 1999
- Inclusion Criteria
  - Histological validation of caries status
  - Sensitivity and specificity reported
- Exclusion Criteria
  - Non-commercial methods

Literature Search

- 1,407 diagnostic reports
- 39 studies selected (126 assessments)
- 65 evaluated radiographic methods
- Critical appraised and scored
- Validity based upon clear and unambiguous assessment of a method for a specific type of lesion on a specific type of surface

Permanent Posterior – Proximal – Cavitated Lesions

Citation, Method	Sites/ Rater	Prevalence	Criteria	Sensitivity	Specificity	Type
Rugg-Gunn, 1972 [12] D speed film	370 – NR	9%	Lesion in enamel & outer ½ dentin	0.35	**1.00**	In Vivo
Downer, 1975 [13] D-speed film	185 – NR	36%	Lesion at DEJ or beyond	0.73	0.97	In Vivo
Mejare, Grondahl, Carlstedt, et al, 1985 [14] D-speed film	598 – 3	5%	Lesion 2/3 enamel thickness	0.36	0.98	In Vivo
Pitts & Rimmer, 1992 [15] D-speed film	1468 – 1	1%	Lesion into dentin	0.87	0.99	In Vivo
Hintze, Wenzel, Danielsen, et al, 1998 [16] E-speed film	338 – 4	6%	Lesion into dentin	0.63	0.93	In Vivo
Espelid & Tveit, 1986 [17] D-speed film	151 – 7	19%	Lesion involving DEJ	0.69	0.89	**In Vitro**
Mean Performance				**0.61 ± 0.21**	**0.96 ± 0.04**	

Permanent Posterior – Proximal – Dentinal Lesions

Citation, Method	Sites/ Raters	Prevalence	Criteria	Sensitivity	Specificity
Mileman & van der Weele, 1990 [18] D-speed film	105 – 276	43%	Lesion into outer ½ of dentin	0.54	0.97
Verdonschot, van de Rijke, Brouwer, et al, 1991 [19] D-speed film	21 – 3	NR	Lesion reaching DEJ	0.50	0.94
Russell & Pitts, 1993 [20] D-speed film E-speed film RVG	240 – 3	NR	Lesion penetrating DEJ	**0.29** 0.30 **0.16**	0.92 0.96 0.96
Ricketts, Whaites, Kidd, et al, 1997 [21] D-speed film	NR 96 teeth 5	13%	Lesion into dentin	**0.16**	0.99
Mean Performance				**0.33 ± 0.16**	**0.96 ± 0.02**

Permanent Posterior – Proximal – All Lesions

Citation, Method	Sites/ Raters	Prevalence	Criteria	Sensitivity	Specificity
Heaven, Firestone, & Feagin, 1992 [22] D-speed film with image analysis	16 – 1	75%	NR	**1.0**	**1.0**
Russell & Pitts, 1993 [20] D-speed film E-speed film RVG	240 – 3	NR	Lesion penetrating DEJ	**0.26** **0.25** **0.15**	0.90 0.90 0.92
Ricketts, Whaites, Kidd, et al, 1997 [21] D-speed film	NR 96 teeth 5	37%	Lesion into dentin	0.27	0.97
Firestone, Sema, Heaven et al, 1998 [23] D-speed film Film image analysis Sensaray image analysis	102 – 1	66%	NR	0.61 0.78 0.73	0.86 0.74 0.82
Mean Performance				**0.51 ± 0.31**	**0.89 ± 0.08**

Permanent Posterior – Occlusal – All Lesions

Citation, Method	Sites/ Raters	Prevalence	Criteria	Sensitivity	Specificity
Wenzel, Fejerskov, Kidd, et al 1990 D-speed film Digitized film enhanced	46 – 2	89%	caries into enamel	0.73 0.79	0.80 0.90
Russell & Pitts, 1993 D-speed film E-speed film RVG	120 – 3	NR	radiolucency penetration beyond DEJ	**0.12** **0.12** **0.15**	0.95 0.96 0.97
Lazarchik, Firestone, Heaven, et al, 1995 D-speed film	100 – 15	79%	caries present	0.58	0.79
Ricketts, Whaites, Kidd, et al, 1997 D-speed film	96 – 5	70%	radiolucency into dentin	**0.27**	0.97
Mean Performance				**0.39 ± 0.30**	**0.91 ± 0.08**

Permanent Posterior – Occlusal – Dentinal Lesions

Citation, Method	Sites/Rater	Prevalence	Criteria	Sensitivity	Specificity
Wenzel, Fejerskov, Kidd, et al 1990 D-speed film Digitized film	46 – 6	72%	caries into dentin	0.63 0.68	0.94 0.98
Wenzel, Hintze, Mikkelsen, et al, 1991 Film, Digitized film, RVG enhanced	81 – 4	67%	caries into dentin	0.63 0.72 0.62 0.69	0.85 0.83 0.83 0.84
Wenzel & Fejerskov, 1992 [26] E-speed film, Digitized film	78 – 1	67%	caries reaching dentin	0.48 0.64 0.71 0.54	0.81 0.82 0.85 0.77
Nytun, Raadal, & Espelid, 1992 Film	30 – 10	77%	radiolucency involving dentin	0.66	**0.50**
Keltey & Holt, 1993 D-speed film	100 – 1	51%	radiolucency into dentin	0.67	0.92
Russell & Pitts, 1993 D-speed ,E-speed film, RVG	120 – 3	28%	radiolucency penetrating beyond DEJ	**0.18** **0.21** **0.21**	0.98 0.99 0.97
Lussi, 1993 D-speed film	63 – 24	44%	caries into dentin	0.45	0.83
Verdonschot, Wenzel, Truin, et al, 1993 E-speed film	81 – 4	67%	dentinal caries	0.61	0.79
Lussi, Firestone, Schoenburg, et al, 1995 D-speed film	26 – 6	42%	caries beyond the DEJ	0.62	0.77
Ricketts, Kidd, Smith, et al, 1997 D-speed film	48 – 12	67%	dentine caries	0.62	0.76
Ekstrand, Ricketts, & Kidd, 1997 D-speed film	100 – 3	39%	radiolucency to middle 1/3 of dentin	0.54	**1.00**
Huysmans, Hitze, & Wenzel, 1997 Digora	189 – 3	55%	caries into dentin	0.60	0.94
Ricketts, Whaites, Kidd, et al, 1997	96 – 5	39%	radiolucency into dentin	**0.14**	0.95
Ashley, Blinkhorn, & Davies, 1998 E-speed film, Digora	103 – 1	36%	radiolucency into dentin	**0.24** **0.19**	0.89 0.89
Huysmans, Longbotton, & Pitts, 1998 E-speed film	107 – 2	41%	radiolucency into dentin	0.58	0.87
Mean Performance				**0.51 ± 0.19**	**0.86 ± 0.11**

Assessment of the Evidence

"Overall the strength of evidence for radiographic methods for the detection of dental caries is *poor* for all types of lesions on proximal and occlusal surfaces"

Deficiencies in the Evidence

- Few reports evaluating primary teeth, anterior teeth and root caries
- High degree of variability in sensitivity and specificity between reports
- Small number of examiners
- High prevalence of caries within sample
- Non-representative teeth
- Incomplete description of decision criteria
- Questionable reference standards

Conclusions from the Evidence

- Radiographic examination provides a higher degree of specificity than sensitivity
- Beneficial if the only intervention is surgical removal of tooth structure
- Detrimental if non-invasive remineralization interventions are to be applied

Conclusions from the Evidence

- Digital radiographic techniques may provide some improvement in sensitivity and reliability
- Computer aided diagnostics may offer hope for significant increases in diagnostic performance
- Guidelines should be developed for assessing new diagnostic methods to improve the internal and external validity of future research efforts.


THANK YOU