











Incidence

- **Incidence** is the number of new cases of a condition, symptom, death, or injury that arise during a specific period of time, such as a year. It is often expressed as a percentage of a population (e.g., 25% of American residents were diagnosed with the flu in 2002).
- **Incidence** conveys the likelihood that an individual in that population will be affected by the condition.

Source: http://www.nlm.nih.gov/medlineplus/ency/article/002387.htm

Caries Incidence in the News

- In general, caries has been decreasing in Western countries
- However, according to an article in *The New York Times, caries has been* <u>increasing</u> in the United States for poor and minority children
- Therefore, the interval between examinations must be individually based on several factors

What do we see on a radiograph?

- Radiographs are useful for caries detection because caries causes demineralization of the tooth structure
- Demineralized tooth structure attenuates the x-ray photons to a lesser extent than sound tooth structure
- A minimum of **60%** demineralization must occur before the lesion can be seen on a film-based radiograph. Digital radiographs are in the **50-55%** range.

What do we see on a radiograph?

- The demineralized area appears more radiolucent than healthy tooth structure
- The contrast between healthy tooth structure and caries allows us to detect the lesion





Which radiographs are best for caries detection?

- Bitewing projections provide optimal visualization of proximal and occlusal caries in the posterior teeth
- Periapicals are appropriate for anterior proximal caries. Paralleling technique improves visibility of the lesion
- Occlusal caries can often be detected on panoramic projections

Which radiographs are best for caries detection?

- As always, aligning instruments are mandatory for optimal results!
- Since carious lesions often have low contrast with surrounding healthy tissue, optimal viewing conditions are imperative.



Which radiographs are best for caries detection?

- Optimal viewing conditions include:
 - Masking borders with a dark mount,
 - Bright, even illumination
 - Dim, indirect room light
- Bitewings should have proper contrast and clear, non-overlapped contacts between teeth











Active versus Arrested caries

- From a single radiograph, it is not possible to determine whether or not a lesion is active
- A follow-up radiograph, it may be able to be determined that the lesion is active, or if the caries is arrested.
- Remineralized lesions may leave a scar, as the remineralized area remains near the surface of the tooth



Active versus Arrested caries • Factors to consider when determining bitewing interval for caries follow-up include: - Hygiene - Hygiene - Fluoridated water - Prior lesions - Diet - Age of patient • CHANCE • Prior lesions • Diet • Age of patient

Se	nsitivit	y and S	Specific	city	
	Gold Standard				
Experir		Positive	Negative	Total	
nental]	Positive	ТР	FP	TP +FP	
Model	Negative	FN	TN	FN +TN	
	Total	TP +FN	FP + TN	$\begin{array}{c} FP+TN+\\ TP+FP \end{array}$	

Sensitivity and Specificity

As the size of the lesion gets smaller, it is more difficult to distinguish the lesion from healthy enamel. It is believed that 50% of all enamel lesions go undiagnosed.

Sensitivity and Specificity

Mileman PA, van der Weele, LT

Accuracy in radiographic diagnosis: Dutch practitioners and dental caries. J Dent. 1990 Jun;18(3):130-6. PMID: 2205637 [PubMed - indexed for MEDLINE]

Sensitivity and Specificity

Mileman PA, van der Weele, LT Accuracy in radiographic diagnosis: Dutch practitioners and dental caries. J Dent. 1990 Jun;18(3):130-6.

"The pooled restorative treatment decisions of the dentists had a mean sensitivity of **62 per cent** and a specificity of **96 per cent**."

Sensitivity and Specificity Studies involving

experienced dentists do not always result in agreement over the presence or absence of small lesions

























Detecting proximal surface lesions

- Proximal lesions are generally located between the contact area and the gingival margin
- It is important to distinguish between caries and cervical burnout. Cervical burnout occurs between the bone height and the cemento-enamel junction



- At the DEJ, the lesion broadens along the junction
- A second triangle is formed, with the apex toward the pulp
- The lesion progresses toward the pulp along the dentinal tubules















Detecting occlusal surface lesions

- Common in children and adolescents
- Starts in pits and fissures, which are often difficult to keep plaque-free
- Can often be detected visually as a discolored or chalky surface. These findings suggest follow-up with bitewings
- Mach band effect may produce false
 positives



Detecting occlusal surface lesions

- As the lesion progresses, there is a fine radiolucent line at the DEJ
- This line is obscured as the lesion progresses, causing false positives and needlessly restored teeth
- Therefore, the *sine qua non* for occlusal caries detection is a clinical examination followed up by radiographic confirmation



Detecting occlusal surface lesions

- The enamel portion of an occlusal lesion may not be seen on a radiograph
- The dentinal portion of the lesion is usually below a fissure
- The buccal pit or buccal pit caries may be superimposed and can be mistaken for occlusal caries. A clinical exam will help to differentiate.

Detecting occlusal surface lesions



















Root Caries

- Occurs on exposed root surfaces and, therefore, is associated with gingival recession
- Can be detected clinically
- Can be confused with cervical burnout
 - Cervical burnout extends from crestal bone to the CEJ
 - Caries will efface the proximal surface of the root and have more diffuse inner borders

























Mach Band Effect

- Where there is a sharply defined difference in density such as the dento-enamel junction, the dentin may appear more radiolucent as the DEJ is approached.
- This can contribute to a false positive reading and unnecessary restoration of sound tooth structure.





lternative Me Dete	thods of Cari ction
Logicon	Computer aided radiology
Transillumination	Enhanced visual examination
Diagnodent	Ultrasound surface analysis





Radiolucency Outline

Logicon Caries Detector (Northrop Grumman Information Technology, Herndon, Va.): tooth image showing selected analysis contours and radiolucency site. DEJ: Dentinoenamel junction. Reproduced with permission of Northrop Grumman Information Technology.









The Take Home Message



- Caries detection on radiographs is a difficult task
- Requires attention in all phases from film selection through viewing
- Despite our best efforts, some lesions will go undetected, while some healthy tooth structure will be needlessly restored

The Raven First published in 1845



"Be that word our sign of parting, bird or fiend!" I shrieked upstarting -"Get thee back into the tempest and the Night's Plutonian shore! Leave no black plume as a token of that lie thy soul hath spoken! Leave my loneliness unbroken! - quit the bust above my door! Take thy beak from out my heart, and take thy form from off my door!