Radiographic Interpretations

Course Author(s): Connie M. Kracher, PhD, MSD
CE Credits: 2 hours
Intended Audience: Dentists, Dental Hygienists, Dental Assistants, Dental Students, Dental Hygiene Students, Dental Assistant Students
Date Course Online: 12/01/2018
Last Revision Date: 02/09/2022
Course Expiration Date: 02/08/2025
Cost: Free
Method: Self-instructional
AGD Subject Code(s): 10, 730

Online Course: *www.dentalcare.com/en-us/professional-education/ce-courses/ce513*

Disclaimer: Participants must always be aware of the hazards of using limited knowledge in integrating new techniques or procedures into their practice. Only sound evidence-based dentistry should be used in patient therapy.

Conflict of Interest Disclosure Statement

- Dr. Kracher reports no conflicts of interest associated with this course. She has no relevant financial relationships to disclose.

Introduction – Radiographic Interpretations

The primary objective of Radiographic Interpretations is to increase your general knowledge of radiographic interpretations by examining case studies.

Course Contents

Overview

Radiographic interpretation is an important part of diagnoses. This course features case studies with radiographic images to assist dental professionals in diagnoses of certain conditions of the oral cavity.

Learning Objectives

Upon completion of this course, the dental professional should be able to:

- Describe dentigerous cysts and understand the implications associated with this condition.
- Describe mesiodens and explain the anatomical and regional perspective relating to these supernumerary teeth.
- Define siaoliths and describe the potential complications associated with this condition.
- Describe odontomas and be able to explain their origin and potential complications.
- Explain idiopathic osteosclerosis and discuss its radiographic appearance.

Introduction

The primary objective of this course is to increase your general knowledge of radiographic interpretations utilizing patient case studies. In this course, the oral conditions include Dentigerous Cyst, Mesiodens, Sialolith, Odontoma, and Idiopathic Osteosclerosis.

Case #1 Diagnoses: Dentigerous Cyst

Radiographic and Clinical Images: Figures 1-3

Demographics: Commonly diagnosed in patients 10-30 years of age. Figures 1 and 2 show radiographic and clinical images of a 7-year old female patient. Slight male predilection than females and a higher prevalence with Caucasians than other ethnicities.[1]

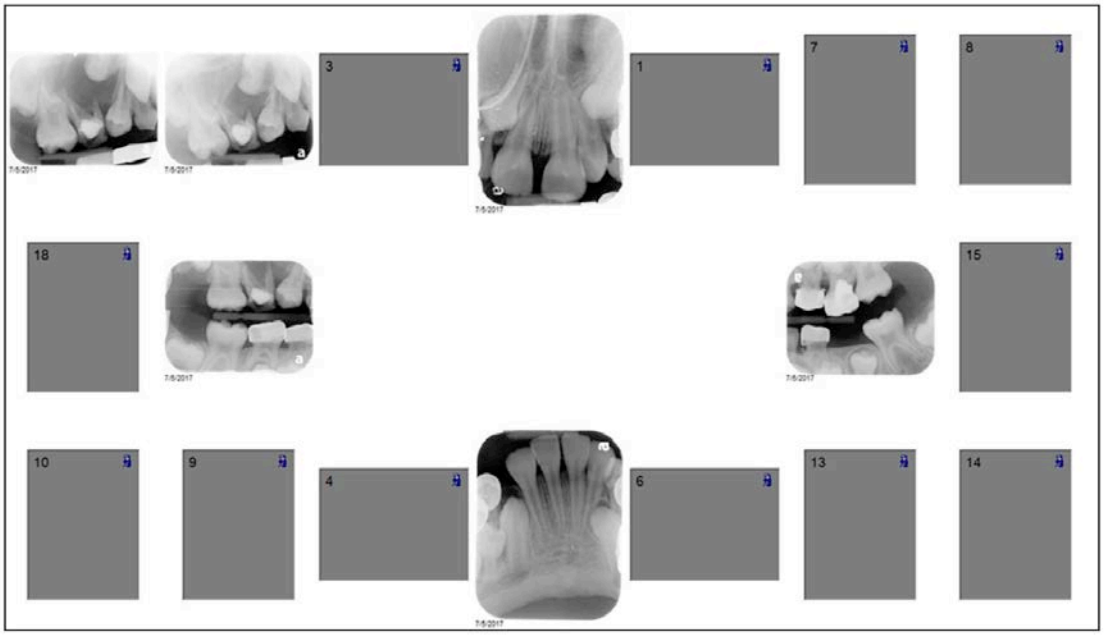

Figure 1. Periapical and Bitewing Images.
Image courtesy of Dr. S. Schwartz.

Figure 2. Dentigerous Cyst.
Image courtesy of Dr. S. Schwartz.

Figure 3. Panoramic Image of a Dentigerous Cyst.
Image courtesy of Dr. S. Schwartz.

A benign cyst lined by squamous epithelium, the dentigerous cyst is found where fluid accumulates between the dental follicle and the crown of the unerupted or partially erupted tooth. It may also occur around a supernumerary tooth. One of the most common developmental odontogenic cysts, accounting for approximately 20% of all epithelial-lined cysts of the jaws. The cyst is attached to the CEJ and results from the proliferation of the reduced enamel epithelium after the enamel is formed. This cyst also has a potential origin from past periapical inflammation associated with a nonvital deciduous tooth. In descending order, most commonly associated with mandibular third molars, maxillary third molars, and maxillary canines due to the potential of impaction. The cyst may destroy alveolar bone, resorption of adjacent tooth roots, or displacement of teeth.

Although rare, the epithelium has the potential to undergo neoplastic change developing into squamous cell carcinoma or ameloblastoma in the wall of the cyst.[2-3]

Clinical Notes: Typically asymptomatic, even if quite large (Figure 3). However, large cysts can develop secondary infection with associated pain and edema.[4] Lesions are found during radiographic imaging. With this case, the lesion is a well-defined unilocular radiolucent lesion present in the area of tooth #4.

Differential Diagnosis: Radiographically small cysts cannot be distinguished from an enlarged dental follicle. When the follicular space exceeds 5 mm from the crown, it is likely a dentigerous cyst. Odontogenic keratocysts and ameloblastomas may mimic the appearance of follicular cysts. To differentiate between lesions, aspiration may be helpful to differentiate with a potential vascular lesion.[3-4]

Treatment: Depending on the type of tooth the dentist may allow the tooth to erupt, e.g., canine. The dentist may wish to incise the lesion (cystotomy) and place a drain allowing shrinkage of the lesion by healing, or in the case of a third molar it will require surgical removal with its epithelial lining (enucleation). When removed, the lesion should be submitted for histopathologic evaluation. Large lesions would require adding bone to fill the defect. Postoperative clinical and radiographic observation should continue.[1-4]

Case #2 Diagnoses: Developing Mesiodens

Radiographic Images: Figures 4-5

Mesiodens are considered supernumerary teeth and they typically develop in the midline between the maxillary incisors of the maxillary arch (Figures 4 and 5). The second most common region of the oral cavity is the third molar region where the supernumerary tooth is known as a fourth molar (paramolar). In fact, mesiodens of the permanent dentition are the most common cause of maxillary incisors failing to erupt. Although mesiodens can occur with primary dentition, it is rare. Mesiodens can develop laterally or bilaterally, single or multiple (mesiodentes), erupted or impacted, upright or inverted, typically present in the maxilla and in rare cases in the mandible. Eighty-two percent of mesiodens occur in the maxilla and are positioned palatal to the central incisors. There are three types: conical or peg-shaped, tuberculate, and supplemental. The most common type is conical. Unerupted mesiodens can cause complications such as malocclusion, root resorption, and in some cases cystic lesion formation. The mesiodens development begins before birth in approximately 50% of the cases but develops later than the primary central incisor dentition. The amount of prenatal enamel found in the extracted mesiodens, postulates the development of mesiodens with a third tooth germ during the last trimester of pregnancy. Compared to primary and permanent central incisor development, mesiodens display a defective morpho-differentiation and lack of mineralization or an incomplete mineralization. When extracted mesiodens are examined, their mineralization is impaired, with a chemical composition showing higher amounts of organic ions and less inorganic ions.[1-6]

Demographics: In the general population, the reported prevalence of mesiodens ranges from .15-3.8% and is more common in males than females with a 2:1 predilection. Mesiodens can be more commonly seen in individuals with physiological conditions including cleidocranial dysotosis, Down syndrome, Gardner syndrome, Nance-Horan syndrome, Ehlers-Danlos syndrome, and trichorhinophalangeal syndrome.[5]

Clinical Notes: The etiology is unclear. A genetic predisposition toward hyperdontia, such as X-linked inheritance has been documented, as well as the dichotomy theory with developing tooth buds and the hyperactivity theory of the restricted increase in the activity of the dental lamina.[7-8]

Treatment: It is difficult to determine when to extract a mesiodens due to its close proximity to developing roots of adjacent permanent teeth. Another factor is the age and cooperation of the child patient.[7-8] CBCT is the preferred imaging technique when diagnosing and treating anomalies.

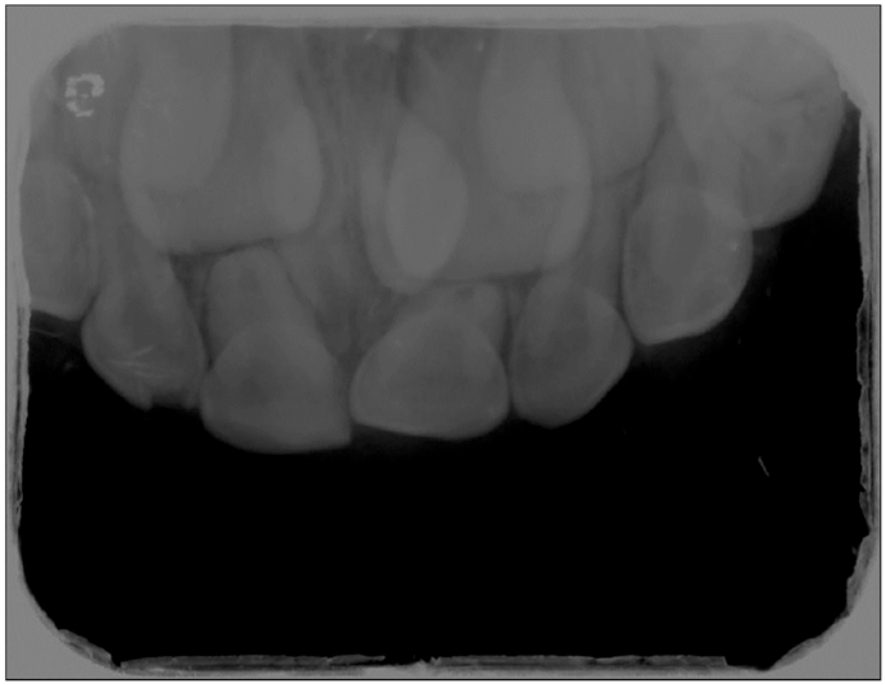

Figure 4. Periapical Image of a Mesiodens.
Image courtesy of Dr. S. Schwartz.

Figure 5. Periapical Image of a Mesiodens.
Image courtesy of Dr. S. Schwartz.

Case #3 Diagnoses: Salivary Stone or Sialolith

Radiographic Images: Figures 6-7

Demographics: Commonly diagnosed in middle-age adults, with 4% of cases occurring in individuals younger than 20 years of age. There is a slight male predilection than females.[3]

Salivary stones or sialolith's are stony calculi that commonly cause salivary gland obstruction and the most common nonneoplastic disease of the major salivary glands. These mineralized stones typically develop in the ducts of the submandibular or parotid glands. Approximately 80-92% form in the Wharton duct of the submandibular gland (Figures 6 and 7), 6-20% form in the Stenson duct of the Parotid gland, and 1-2% occur in the sublingual glands. The rationale for a higher prevalence of calcifications in the submandibular glands may be due to the saliva having more viscous, mucoid secretions than parotid glands and the anatomical configuration where the Wharton's duct has two bends. One is located at the posterior border of the mylohyoid muscle and the other is around the opening of the duct (punctum) where the duct makes a sharp bend before emptying saliva into the oral cavity. The diameter of the salivary gland ducts on average is 2-4 mm. However, it is narrower at the salivary gland duct openings.[2-5,9]

Although considered idiopathic, salivary stones may occur due to the secretion of calcium-rich saliva in conjunction with a partial obstruction of the salivary gland duct due to bacteria, foreign bodies, collection of viscous mucus, or ductal epithelial cells. These blockages may cause an acute or chronic inflammation at the duct site. Other causes of salivary stones may include dehydration and medications. Salivary stones may also occur in minor salivary glands. However, they are rare. If a minor salivary gland duct is blocked, the dental professional can identify the stones in the upper lip and buccal mucosa areas appearing as small, firm nodules. It is important to note that salivary stones may occur secondary to neoplasms, such as acinic cell or mucoepidermoid carcinomas.[3-4]

Clinical Notes: Hyposalivation or xerostomia are one of the first symptoms of salivary duct blockage. Pain, edema, and inflammation may occur. Typically, the edema is sudden and associated with the patient eating a meal. Patients with minor salivary gland stones

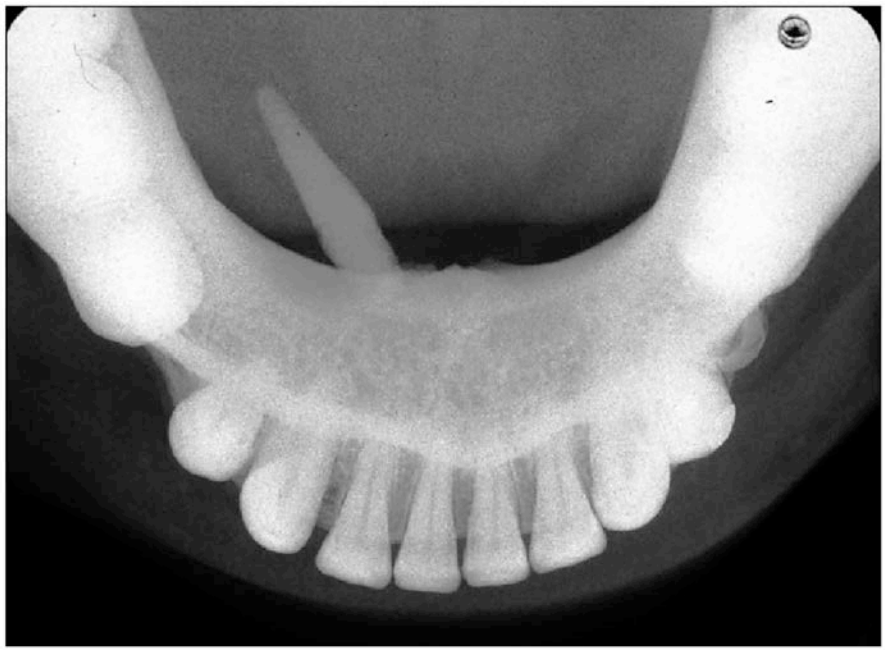

Figure 6. Occlusal Image of a Sialolith.

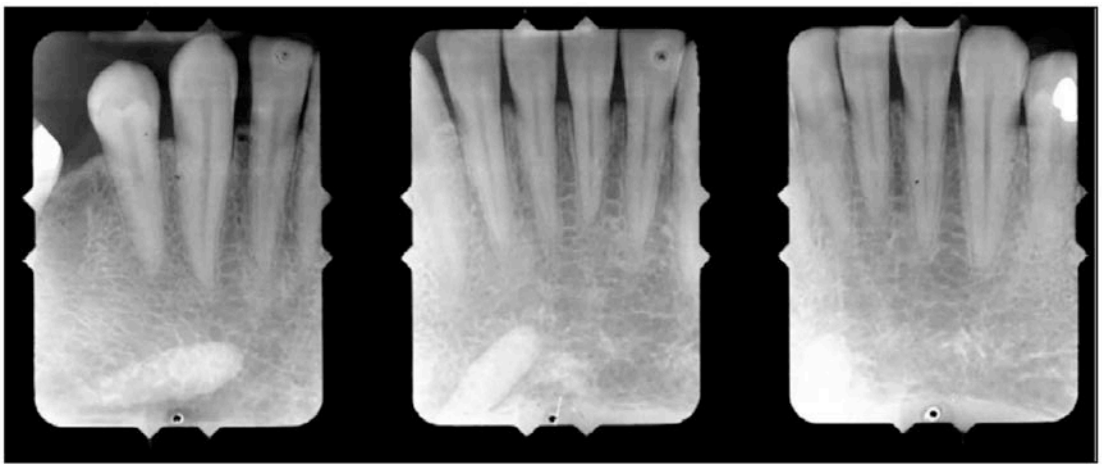

Figure 7. Periapical Images of a Sialolith.

are typically asymptomatic. Radiographically salivary stones range from tiny particles to stones that are several centimeters in size. They typically appear radiopaque. However, some stones may appear radiolucent.4

Differential Diagnoses: Sjögren syndrome, obstructive sialadentitis, salivary gland tumors, or epidemic parotitis (mumps). If mumps are suspected, look for other symptoms such as fever, malaise, and acute persistent pain and edema of the parotid gland along with inflammation of the papilla of the Stenson duct. Do not dilate the salivary duct (balloon dilation) if the patient has a suspected case of mumps. Salivary stones are primarily composed of calcium phosphate and hydroxyapatite. However, uric acid stones may form in patients with gout. As many as 10% of individuals diagnosed with salivary stones also exhibit stone formation in the urinary tract and bile duct system.[4]

Treatment: If left untreated, salivary stones can result in chronic sialadentitis (infection of the salivary gland) and glandular atrophy (decrease in the saliva gland size). Conservative treatment includes oral analgesics and antibiotics for secondary infections or the potential for secondary infections after a protracted or traumatic surgery. Surgical management includes salivary lithotripsy (ultrasonic wave therapy) or sialendoscopy (surgical removal). Salivary stones smaller than 7 mm in diameter, relatively mobile, and proximal anatomical positioning are good candidates for removal with forceps or wire stone removal baskets utilizing endoscopic guidance. With salivary stones larger than 7 mm, lithotripsy is indicated. The ultrasonic pulses cause the stones to be fragmented and are either removed if they are still large or excreted by saliva. The stones will appear white, yellowish, or tan in color and smooth or rough in appearance. When removed, the calcifications may crumble (friable).[3]

Case #4 Diagnoses: Complex Odontoma

Radiographic Images: Figures 8-9

Demographics: Can be seen more commonly in children and young adults.

Odontomas are the most common benign odontogenic tumor (Figures 8 and 9). Abnormal proliferation of cells of the enamel organ, they give rise from the odontogenic epithelium and mesenchyme that produce enamel and dentin. There are two types of odontomas: compound and complex. A compound tumor represents multiple toothlike structures, where a complex odontoma has irregularly shaped masses of enamel (amorphous) showing no anatomic resemblance to a tooth. The tumor consists of multiple hard tissues, e.g., enamel, dentin, and cementum. If miniature teeth can be recognized in the lesion, it is called compound odontoma. If not then it's called a

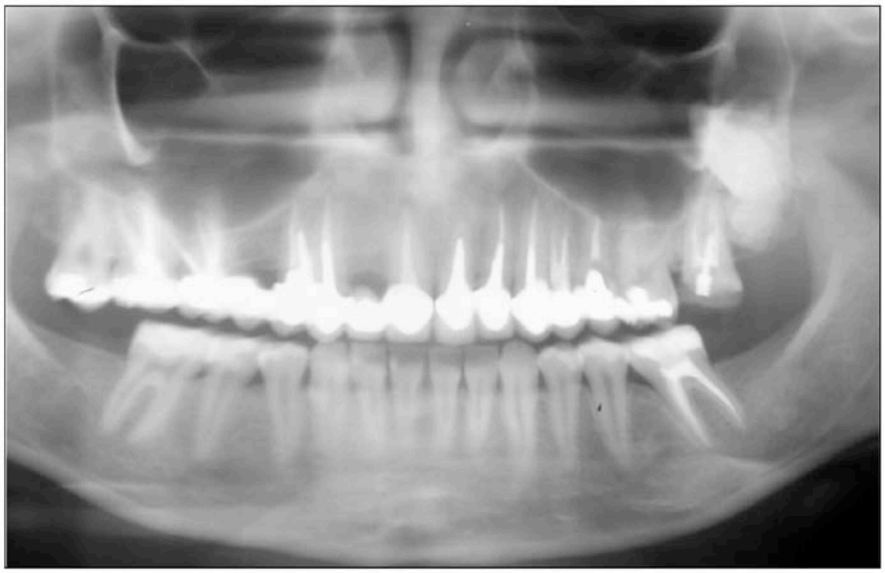

Figure 8. Panoramic Image of a Complex Odontoma.

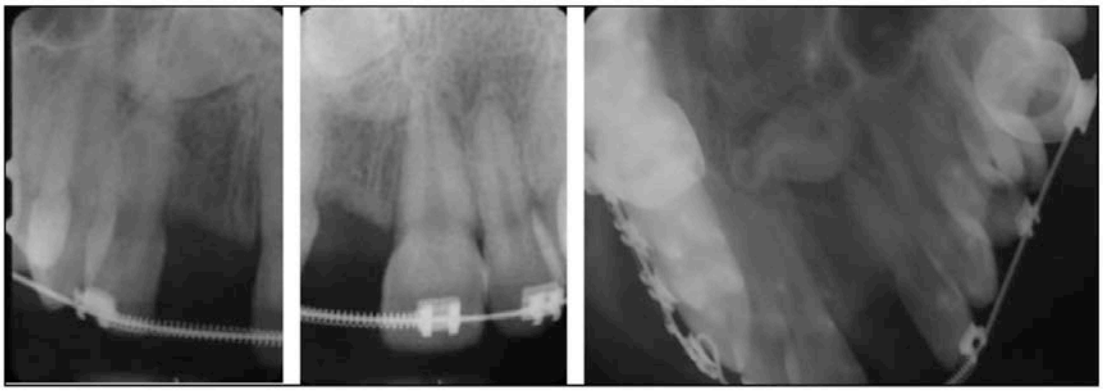

Figure 9. Periapical and Occlusal Images of an Odontoma.

complex odontoma, like this case. The complex odontoma is the most common odontogenic tumor in relation to tooth eruption. Compound odontomas occur in the canine and incisor region, found more often in the maxilla than mandible, and occur in children on average 14.8 years of age. Complex odontoma tumors occur in the posterior jaws in children 20.3 years of age on average. In one research study, 48% of cases involving unerupted teeth were diagnosed as odontomas, where 28% of unerupted teeth were dentigerous cysts.[1-4]

Clinical Notes: Usually asymptomatic and slow-growing. Found during a radiographic examination when a tooth has not erupted and possible retention of deciduous teeth. An encapsulated tumor, it rarely destroys alveolar bone or resorbs adjacent tooth roots. The dental team should inquire about the concurrent presence of dysphagia or a family history of dysphagia.[3]

Differential Diagnoses: An odontoma associated with a dentigerous cyst is rare. Another rare diagnosis is the amelobastic odontoma, e.g., odontoameleoblastoma. Although similar in age range and clinical location to the odontoma, the neoplastic tumor has a clinically aggressive growth.[3-4]

Treatment: Except for rare, large, complex lesions like this case, odontomas do not require treatment unless they block tooth eruption. If surgical removal, enucleation of the surrounding epithelial tissue including

mucoperiosteal flap to expose the tumor, curettage, and if needed overlying bone is removed via highspeed handpiece. The tumor should be submitted for histopathologic evaluation. Large lesions would require adding bone to fill the defect. Postoperative clinical and radiographic observation should continue.[1-4,10]

Case #5 Diagnoses: Idiopathic Osteosclerosis (Dense Bone Islands)

Radiographic Image: Figure 10

Demographics: Average age for Dense Bone Island (DBI) is twenties and thirties, with a 2:1 female predilection to males.

DBI is a form of idiopathic osteosclerosis, presented as an increased development of compact bone (enostoses) that extends from the inner surface of cortical bone into cancellous bone, with defined borders (Figure 10). DBI can occur in alveolar bone, as well as other skeletal regions such as the pelvic, long bones, and spine. They may be located at the apical regions of teeth, inter-radicular, or no regional attachment to dentition. The lesions do not appear to be associated with nonvital teeth, as it is with condensing osteitis. The etiology of DBI is unknown. Some studies speculate they are a result of a developmental resorption error during endochondral ossification. Radiographically they do not typically show bone expansion buccolingually or displace adjacent teeth or bony anatomic structures. However, in one study 9.7% of cases showed resorption of the first permanent molars.[5,11-13]

Clinical Notes: Individuals are typically asymptomatic. Radiographically osteosclerosis is commonly seen as a radiopaque lesion found in the mandibular premolar and molar regions, with the first molars being the most common teeth. The bone islands range from 2.5 to 7.0 cm.[5,11]

Differential Diagnoses: Condensing osteitis, hypercementosis, benign neoplasms.

Treatment: None.

Conclusion

Radiographic interpretation is an important part of diagnoses. We need to know what is normally found clinically and radiographically before we can diagnose lesions. This course included case studies with radiographic images to assist dental professionals in diagnoses of certain conditions of the oral cavity. As clinicians we must utilize clinical examination, radiographic imaging, patient signs and symptoms, differential diagnoses, biopsies as appropriate, and other diagnostic methods to determine the final diagnosis of a lesion.

Figure 10. Panoramic Image of a Dense Bone Island.

Course Test Preview

To receive Continuing Education credit for this course, you must complete the online test. Please go to: *www.dentalcare.com/en-us/professional-education/ce-courses/ce513/test*

1. A dentigerous cyst is more commonly found in patients under 30 years of age.
A. True
B. False

2. Male patients are more likely to be diagnosed with a dentigerous cyst than female patients. Caucasians are more likely to be diagnosed with a dentigerous cyst than other ethnicities.
A. Both statements are true.
B. Both statements are false.
C. The first statement is true, and the second statement is false.
D. The first statement is false, and the second statement is true.

3. Patients diagnosed with a dentigerous cyst are typically symptomatic e.g. acute pain and sensitivity to thermal conduction.
A. True
B. False

4. Where is the most common region for patients to develop mesiodens?
A. Maxillary posterior
B. Mandibular posterior
C. Mandibular anterior
D. Maxillary anterior

5. Mesiodens typically occurs with permanent dentition. Although rare, it can occur with deciduous dentition.
A. Both statements are true.
B. Both statements are false.
C. The first statement is true, and the second statement is false.
D. The first statement is false, and the second statement is true.

6. Female patients are more likely to be diagnosed with a mesiodens than male patients.
A. True
B. False

7. The majority of salivary stones diagnosed are found in the Stenson duct of the parotid gland. Salivary stones may occur in minor salivary ducts but are rare.
A. Both statements are true.
B. Both statements are false.
C. The first statement is true, and the second statement is false.
D. The first statement is false, and the second statement is true.

8. Sialolith's or salivary stones are typically diagnosed in patients that are middle age.
A. True
B. False

9. Patients diagnosed with minor salivary stones are typically asymptomatic.
A. True
B. False

10. Odontomas are the most common benign odontogenic tumor. In relation to tooth eruption, the complex odontoma (amorphous enamel) is the most common odontogenic tumor.

A. Both statements are true.
B. Both statements are false.
C. The first statement is true, and the second statement is false.
D. The first statement is false, and the second statement is true.

11. Compound odontomas occur most often in the posterior region of the oral cavity. Odontomas are typically asymptomatic.

A. Both statements are true.
B. Both statements are false.
C. The first statement is true, and the second statement is false.
D. The first statement is false, and the second statement is true.

12. Odontomas are commonly seen in children and young adults.

A. True
B. False

13. Patients diagnosed with idiopathetic osteosclerosis are typically asymptomatic.

A. True
B. False

14. Male patients are more commonly diagnosed with idiopathic osteosclerosis than female patients.

A. True
B. False

15. The most common teeth diagnosed with idiopathic osteosclerosis are the mandibular first molars.

A. True
B. False

References

1. McDonald JS. McDonald and Avery's dentistry for the child and adolescent, 10th Ed. St. Louis, MO. Elsevier, 2016.
2. Brennan PA, Schliephake H, Ghali GE, Cascarini L. Maxillofacial surgery, 3rd Ed. Edinburgh. Churchill Livingstone, 2017.
3. Bagheri SC. Clinical review of oral and maxillofacial surgery, 2nd Ed. St. Louis, MO. Elsevier, 2014.
4. Weidner N, Cote RJ, Suster S, Weiss LM. Modern surgical pathology, 2nd Ed. St. Louis, MO. Elsevier, 2009.
5. Iannucci JM, Howerton LJ. Dental radiography: principles and techniques, 5th Ed. St. Louis, MO. Elsevier, 2017.
6. Bagheri SC, Bell RB, Khan HA. Current therapy in oral and maxillofacial surgery. St. Louis, MO. Elsevier, 2012.
7. Itaya S, Oka K, Kagewa T, et al. Diagnosis and management of mesiodens based on the investigation of its position using cone-beam computed tomography. Pediatric Dental Journal. 2016 Aug;26(2):60-66. Accessed February 9, 2022.
8. Muhamad A, Moti M, Ornit C, et al. Histological and chemical analyses of mesiodens development and mineralization. Arch Oral Biol. 2018 Mar;87:191-195. doi: 10.1016/j.archoralbio.2017.12.020. Epub 2017 Dec 23.
9. Haring JI. Diagnosing salivary stones. J Am Dent Assoc. 1991 May;122(5):75-6.
10. Gnepp DR. Diagnostic surgical pathology of the head and neck, 2nd Ed. St. Louis, MO. Saunders, 2009.
11. Kawai T, Murakami S, Kishino M, et al. Gigantic dense bone island of the jaw. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1996 Jul;82(1):108-15.
12. McDonnell D. Dense bone island. A review of 107 patients. Oral Surg Oral Med Oral Pathol. 1993 Jul;76(1):124-8.
13. Araki M, Matsumoto N, Matsumoto K, et al. Asymptomatic radiopaque lesions of the jaws: a radiographic study using cone-beam computed tomography. J Oral Sci. 2011 Dec;53(4):439-44.

Additional Resources

- No Additional Resources Available

About the Author

Connie M. Kracher, PhD, MSD

Dr. Kracher is an Associate Professor of Biology and Director of the Institute for Research at Purdue University Fort Wayne. She holds a PhD from Lynn University in Boca Raton, Florida and a Master of Science in Dentistry in the Departments of Oral Biology and Diagnostic Sciences from Indiana University School of Dentistry. Dr. Kracher is a consultant for national dental organizations and has presented for the American Dental Association, American Dental Education Association, and the World Dental Federation. Dr. Kracher is a member of several professional organizations, including the American Association of Dental Research.

Email: kracher@ipfw.edu