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Diagnostic Imaging of Systemic Diseases Manifested in Jaws

A Project Submitted to

The College of Dentistry, University of Baghdad, Department of Oral Diagnosis Clinic in Partial Fulfillment for the Bachelor of Dental Surgery

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وَمَا تَوْفِيقِيٓ إِلَّا بِٱللَّهِ
عَلَيْهِ تَوَكَّلْتُ وَإِلَيْهِ أُنِيبُ

Dedication

To god almighty, who graced my life with opportunities, my source of inspiration and strength, the one who never give up on nobody.

To my parents, my mentors, for encouraging me and rising me believing that everything is possible.

To my brothers and sister, without whom none of this would be possible.

To my friends who I shared this journey and memories with.

Acknowledgment

I would like to express my gratitude to **Dr. Raghad alhashimi** Dean of College of Dentistry, University of Baghdad and **Dr. Bashar Hamid Abdullah** the Head of the Department of Oral Diagnosis and all the professors and seniors in the Department for their help especially my supervisor **Dr. Farah A. Hadi** for guiding me in this research and teaching me. Proud to be learning under your direction.

Certification of the Supervisor

I certify that this project entitled " **Diagnostic Imaging of Systemic Diseases Manifested in Jaws**" was prepared by the fifth-year student Jannat Nadhom Kadhum under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the graduation requirements for the Bachelor Degree in Dentistry.

Supervisor's name: **Assistant Lecturer Dr. Farah A. Hadi**

Date

Certification of the Discussion Committee

We, the members of the discussion committee, certify that we have read and examined this graduation project and that in our opinion it of a graduation project. meets the standard.

Signature **Signature** **Signature**

Approved by the head of Oral diagnosis department at the college of dentistry, University of Baghdad.

Signature

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BMD	bone mineral density
CCD	Cleidocranial dysplasia
FD	Fibrous dysplasia
GNAS	Guanine nucleotide-binding protein a-stimulating polypeptide
MAS	McCune-Albright syndrome
SCD	Sickle cell disease
PTH	parathyroid hormone
QUS	quantitative ultrasound
RMI	radiomorphometric indices

Introduction

Systemic disease can be manifested in the jaws in multiple ways. The manifestations can be limited to the teeth or may extend to involve the soft and hard tissues that form the oral cavity. Mandibular and maxillary bone often is the target. In this review of literature, individual disease entities that have both systemic and dental manifestations and a summary of the most common jaw affected, radiographic and pathognomonic findings are discussed **(Ko et al., 2021)**.

Panoramic radiography produces an image that includes both the maxillary and mandibular dental arches and the such surrounding structures as the maxillary antra, nasal fossa, temporomandibular joints, styloid processes, and hyoid bone. Although, dentists might concentrate only on the teeth and their supporting tissues when the examining panoramic radiographs, they should also be able to identify all other structures that appear in the image **(White et al., 2005)**.

Because systemic disorders affect the entire body, the radiographic changes manifested in the jaws are generalized. In most cases it is not possible to identify diseases on the basis of radiographic characteristics. The general changes include the following **(Stuart, 2009)**:

1. A change in size and shape of the bone

2. A change in the number, size, and orientation of trabeculae

3. Altered thickness and density of cortical structures

4. An increase or decrease in overall bone density

Systemic conditions that result in a decrease in bone density do not affect mature teeth; therefore the image of the teeth may stand out with normal density against a generally radiolucent jaw. In severe cases the teeth may

appear to be bereft of any bony support. Also, cortical structures appear thin, less defi ned, and occasionally disappear. On the other hand, a true increase in bone density may be detected by a loss of contrast of the inferior cortex of the mandible as the radiopacity of the cancellous bone approaches that of cortical bone. Often the inferior alveolar nerve canal appears more distinct in contrast to the surrounding dense bone **(Ghapanchi et al., 2018)**.

Some systemic diseases that occur during tooth formation may result in dental alterations. Lamina dura is part of the bone structure of the alveolar process, but because it is usually examined in conjunction with the periodontal membrane space and roots of teeth, it is included with the description of the dental structures. Changes to teeth and associated structures include the following: 1. Accelerated or delayed eruption 2. Hypoplasia 3. Hypocalcifi cation 4. Loss of a distinct lamina dura **(Stuart, 2009).**

While panoramic radiograph should not be prescribed primarily for detection of non-maxillofacial conditions, it is incumbent upon the health practitioner to be cognizant of panoramic image features that are indicative of systemic health. **(Watanabe et al., 2004)**.

Chapter 1

Review of Literature

Chapter one: review of literature

1.1 Diseases of Bone Manifested in Jaw

1.1.1 Osteoporosis

Osteoporosis is a degenerative or metabolic bone disease associated with increased fracture risk, if left untreated or undiagnosed for long periods of time. Patients with this condition present with low bone mineral density (BMD) as well as changes in bony tissue structure. Osteoporosis is more prevalent in populations with deficiency in sex hormone, estrogen depletion (usually in postmenopausal women), and advanced age **(Giro et al., 2015)**.

1.1.1.1 Clinical and Radiographic Findings: Patients who have low trauma fractures in bones not easily susceptible to fracture raise a suspicion for osteoporosis. The exception, however, is those with other previously diagnosed bone diseases like multiple myeloma. Postmenopausal women over the age 50 years also are more likely to have osteoporosis as are men and women over the age of 65 years. Other clinical risk factor, include alcoholism, smoking, and low body weight (<57.6KG). Panoramic radiographic findings include an alteration in trabecular pattern of the bone and thinning of the mandibular cortex (Fig. 1) **(Pauwel et al., 2015)**.

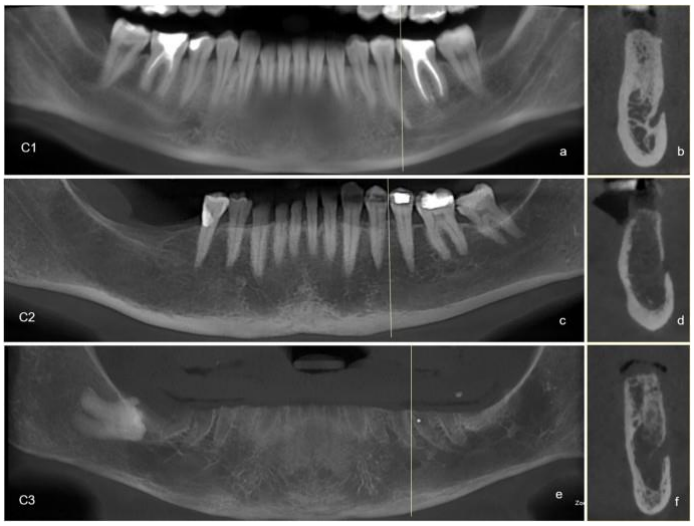

Figure 1-1: cone-beam computed tomography of osteoporotic patient (De Castro et al., 2020)

1.1.2 Paget's disease of bone

Paget disease is a disorder of bone remodeling initiated by increased osteoclast mediated bone resorption with compensatory increased formation of new bone and abnormal bone turnover. Skeletal sites affected by Paget disease display an expansion of disorganized mosaic of woven and lamellar bone that is less compact, more vascular, and more susceptible to deformity and fracture. Paget disease may affect 1 bone (monostotic) or multiple bones (polyostotic) **(Dos Santos et al., 2018)**.

1.1.2.1 Clinical Manifestations and Radiographic Presentations

Clinical presentations of Paget disease vary from patient to patient and from one skeletal site to the other. Although some patients may be asymptomatic, others may experience bone pain, deformity, fracture, compression of adjacent nerves, and excessive warmth due to bone hypervascularity. The skull bones commonly are affected and the disease could extend to the maxillofacial bones, causing facial disfigurement and dental malocclusions (Fig. 2). Most Paget disease patients are asymptomatic, so the disease may be discovered due to incidental

radiographic findings and abnormal markers of bone turnover. Radiographically, the early-stage Paget disease is radiolucent as bone resorption occurs. This can transition to granular radiographic pattern that eventually may become irregular distributed radiopaque appearance. The maxilla and mandible often are enlarged while the teeth also could display loss of the lamina dura. These radiographic changes in the jaw present as a spotty cotton wool–like appearance in the trabecular and periapical regions. Some posterior teeth could display hyperplasia of the cementum and hypercementosis (**Bender, 2003; Ahmad and Gaalaas, 2018)**.

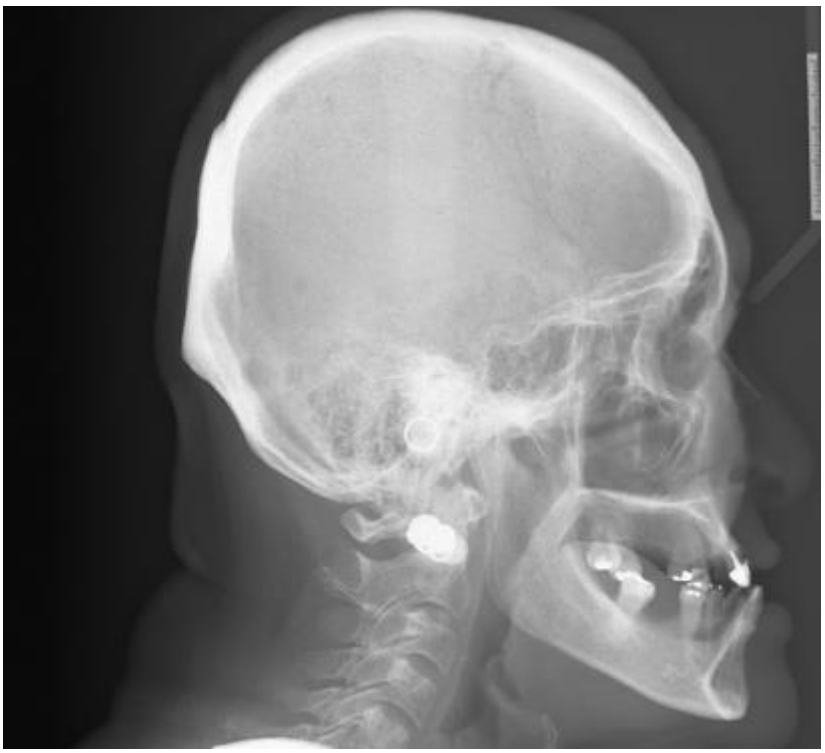

Figure 1-2: Lateral cephalometric view of a patient whose chief complaint was anterior malocclusion and mandibular prognathism that recently was noticed (Theodorou et al., 2011).

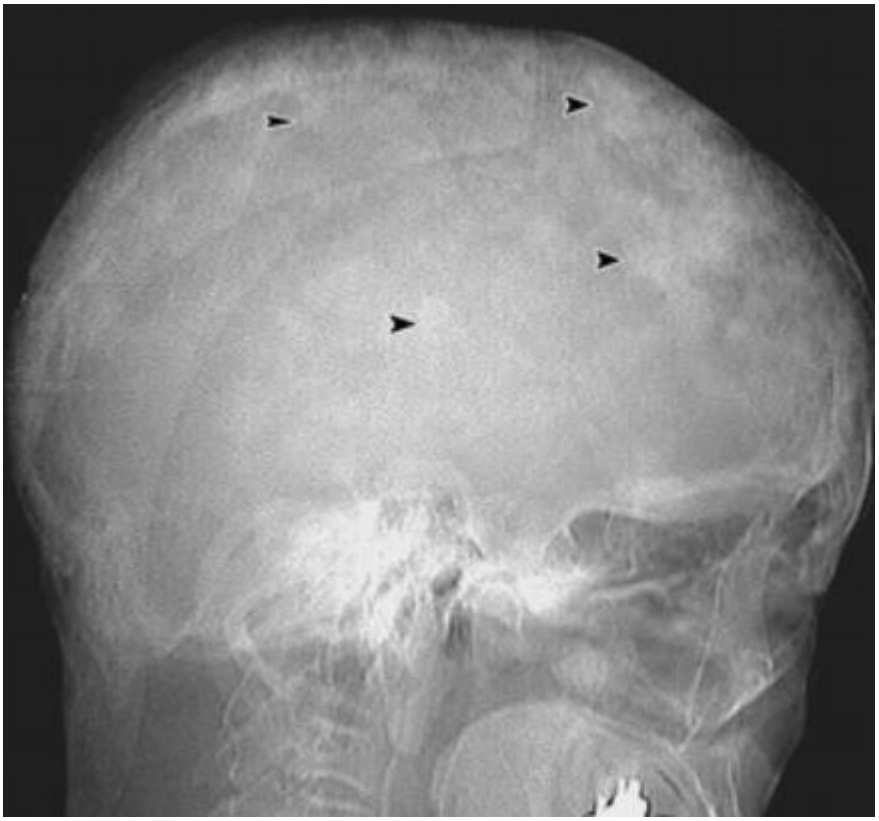

Figure 1-3: Lateral skull radiograph of 64-year-old woman with Paget disease reveals several areas of focal sclerosis (*arrowheads*) that produce cotton-wool appearance (Theodorou et al., 2011).

1.1.3 Cleidocranial dysplasia

Cleidocranial dysplasia (CCD) is a rare genetic disorder, reported in 1 in every 100,0000 cases, and is inherited as an autosomal dominant genetic trait. CCD represents several skeletal abnormalities **(Mundlos, 1999)**.

Clinical and Radiographic

Presentation Also known as cleidocranial dysostosis, this is a rare skeletal disorder with defective or absent clavicles causing sloping shoulders, moderately short stature, delayed eruption of teeth, incomplete development or absence of teeth, hypoplastic enamel, and supernumerary teeth (Fig. 3) apart from other features like delayed closure of fontanels,

deformations of chest, and abnormal pelvic and pubic bones, which are common among other skeletal deformities. Individuals with CCD have increased risk for recurrent ear and sinus infections and upper respiratory tract problems as well as hearing loss **(Ko et al., 2021)**.

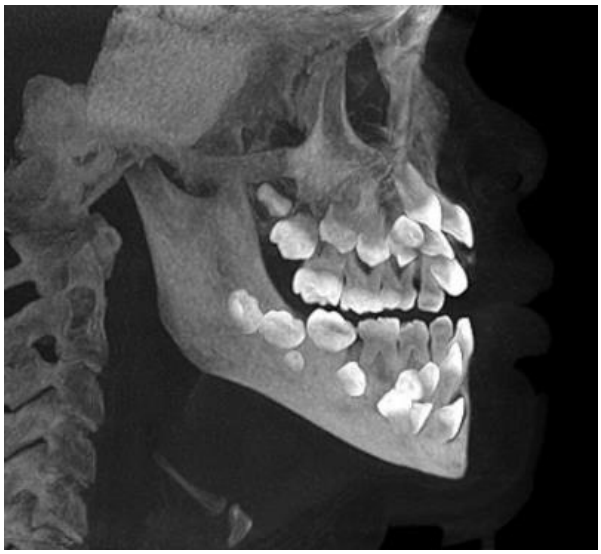

Figure 1-4: Maximum intensity projection–rendered lateral skull reconstruction of the right side in a patient with CCD showing multiple unerupted supernumerary teeth in maxilla and mandible (Ko et al., 2021)

1.1.4 Fibrous Dysplasia

Fibrous dysplasia (FD) is a genetically mosaic skeletal disorder caused by somatic missense mutations of the alpha-subunit of the stimulatory G protein encoded at the GNAS locus on chromosome 20q13.3 **(Bianco et al., 2000)**. The result is a gain-of-function mutation that impairs intrinsic activity of GTPase, leading to excessive production of intracellular cAMP. FD is an uncommon skeletal disorder with a broad spectrum of clinical presentation that ranges from incidental radiographic discovery in adulthood to a severely handicapping disease that presents early in life. FD is classified as monostotic FD when it involves 1 bone, polyostotic FD

when it involves multiple bones, or panostotic FD when the entire skeleton is affected. FD often is associated with a wide range of extraskeletal manifestations that include cafe´ au lait skin hyperpigmentation and hyperfunctioning endocrinopathies, such as growth hormone excess, precocious puberty, hyperthyroidism, and Cushing syndrome. McCune-Albright syndrome (MAS) is a combination of FD with cafe´ au lait skin pigmentation and 1 or more endocrinopathies **(Foster, 2014)**. Although less common than MAS, polyostotic FD in the absence of endocrinopathies is referred to as Jaffe-Lichtenstein syndrome and association of FD with intramuscular myxomas is called Mazabraud syndrome. Production of excessive fibroblast growth factor 23 (FGF-23) by dysplastic FD bone cells can lead to renal phosphate wasting, and FD within the context of MAS has been associated with disorders of the pancreas, heart, liver, and other organs **(Collins et al., 2001)**.

1.1.4.1 Clinical Presentation and Radiographic Presentations

Clinical presentation of FD is variable depending on the severity of the FD lesions and skeletal sites affected, which could be a combination of craniofacial, appendicular, and axial skeletons. FD lesions can cause severe bone pain. Craniofacial bones commonly are affected with extensive expansion of the skull, maxilla, and mandible, resulting in severe facial disfigurement. Additionally, dental features associated with jaw FD may include enamel hypoplasia and hypomineralization, dentin dysplasia, odontoma, taurodontic pulp, and high caries index **(Akintoye et al., 2013; Burke et al., 2017)**. Panoramic radiograph and CT display homogeneous jaw FD lesion as ground-glass appearance whereas a heterogeneous lesion appears sclerotic with a mixed radiolucent/radiopaque regions (Fig. 1-5). Although rare, sarcomatous change of FD should be suspected in a rapidly expanding FD lesion **(Akintoye et al., 2004)**.

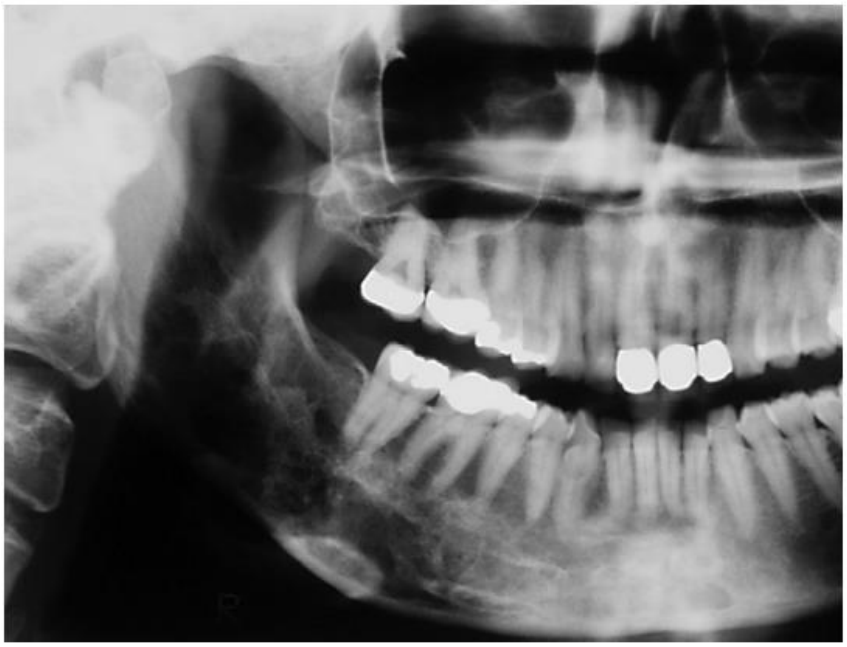

Figure 1-5: Cropped panoramic radiograph showing a heterogeneous sclerotic lesion with mixed radiolucent/radiopaque areas on this right mandible (Pereira et al., 2019).

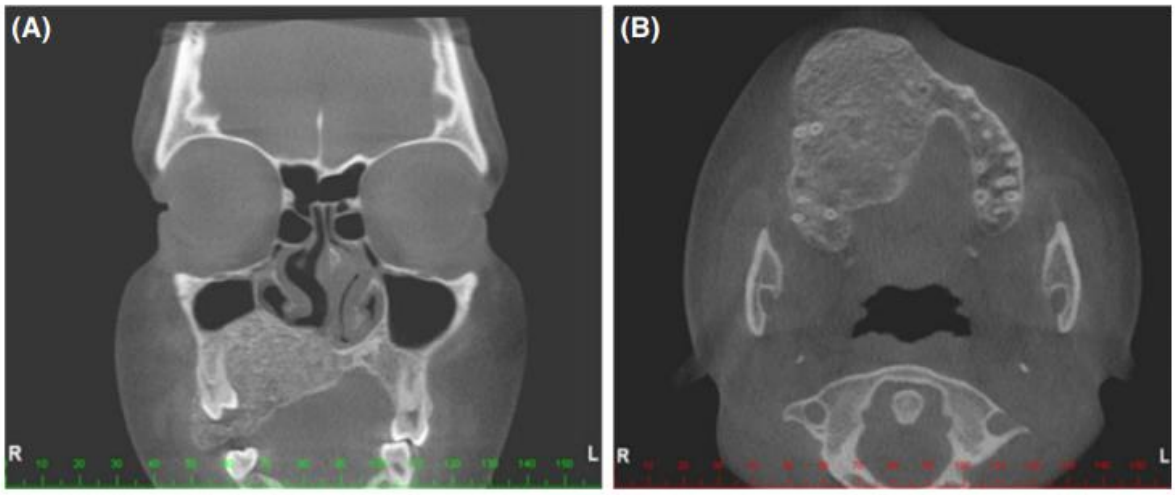

Figure 1-6: A representative example of fibrous dysplasia computerized tomographic scan. Coronal (A) and axial (B) images show an expansive maxillary lesion with poorly defined borders (Pereira et al., 2019)

1.1.5 Cherubism

Cherubism is a rare familial bone disease characterized by resorption limited to the jaws. Cherubism is defined by the appearance of symmetric, multilocular radiolucent lesions of the mandible and/or maxilla (Fig. 1-7) that typically appear at the age of 2 years to 7 years. Clinically, this can manifest as a cherubic appearance—full round cheeks with the upward casting of eyes21—and enlargement of cervical lymph nodes, a high arched palate, and early loss of primary teeth. Moreover, supernumerary and missing teeth are common findings in patients with cherubism **(Papadaki et al., 2012)**.

Diagnostic Approach

Radiographic findings should raise suspicion for the disease. Common findings include bilateral multiloculated areas of the jaws that can clinically cause expansion. Additionally, radiographic findings can include multiple unerupted, impacted teeth in varying stages of development. Genetic testing may determine the presence of mutation in the cherubism gene SH3BP2 **(Rechenberger et al., 2012)**.

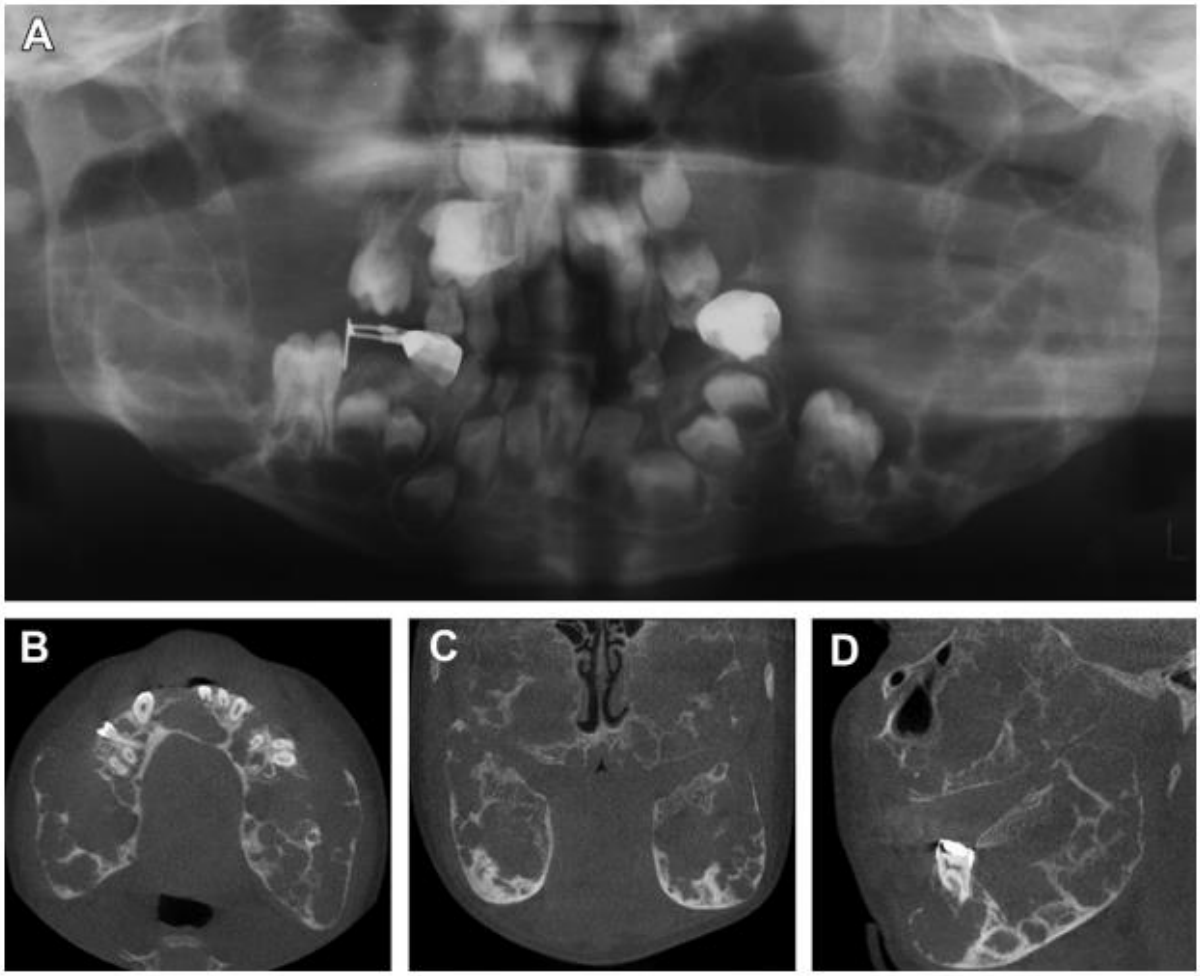

Figure 1-7: (A) Panoramic radiograph of a child with cherubism shows bilateral, multilocular, expansile lesions in the posterior mandible and maxilla are evident and characteristic of the condition. Multiple teeth have been displaced largely in an anterior direction. (B) Axial, (C) coronal, and (D) sagittal CBCT sections demonstrate significant bony expansion bilaterally in both jaws. Note the multilocular appearance of the lesions (Ahmad and Gaalaas, 2018).

1.2 Blood disorders

1.2.1 Sickle cell disease

Sickle cell disease (SCD) is an inherited autosomal recessive disorder of the red blood cells, in which the disc shape of red blood cells is replaced by less flexible sickle-shaped cells. These abnormally shaped cells are fragile and sequester together, obstructing blood flow through the vessel wall. This results in hemolytic anemia and vasoocclusive crisis, which can affect any organ system in the body, including the bones of the head and neck, with a consequence of organ failure. This condition is most common in sub-Saharan Africa. Other areas include the Middle East, India, and Mediterranean area **(Ko et al., 2021)**.

1.2.1.1 Clinical and Radiographic Presentation

The mandible is the second most common site of bone involvement in the head and neck region, with the orbital wall the most common head and neck site. Bone infarction/ischemia from vasoocclusion as well as osteomyelitis can occur in acute phases and bone marrow hyperplasia, osteoporosis, and/or osteonecrosis from recurring infarctions; transfusion-induced iron deposition in the bone is noted in chronic phases. Neuropathies also have been reported after a vasoocclusive crisis as a result of involvement of the inferior alveolar nerve. Radiographically, abnormal bony trabeculae pattern is noted as wide spacing and decreased radiodensity, commonly referred to as stepladder changes (Fig. 1-8). Osteosclerosis is seen in 15% of cases, and osteolysis may be noted in areas of bony infarcts. Osteoporosis/osteopenia is the finding reported most frequently in patients with SCD. Avascular necrosis, noted most commonly in the femoral head, is the most debilitating bone complication of SCD. Osteomyelitis, although reported in less than 5% of patients with SCD, has

been reported. When it does occur, it tends to affect the mandible. On magnetic resonance imaging (MRI), areas of bony infarcts may present with high signal intensity, whereas areas of iron deposits in bone may present with low to intermediate signal intensity **(De Luna et al., 2018)**.

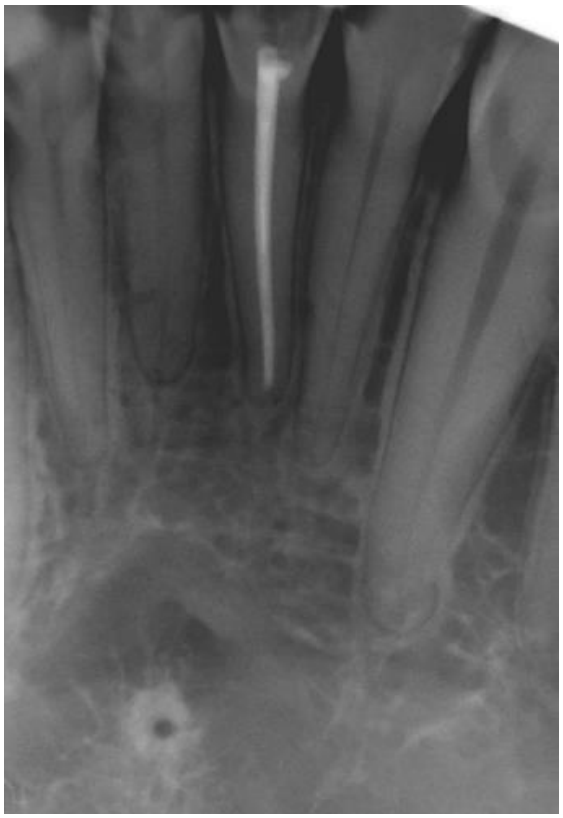

Figure 1-8: SCD showing abnormal bony trabecular pattern in this mandibular central incisor posteroanterior radiograph. Note the prominent lingual foramen in this radiograph surrounded by large expanded bone marrow spaces suggestive of the underlying pathology. It is not common to find such a clear representation of the sickle cell–related findings in intraoral radiographs (Ko et al., 2021)

1.2.2 Thalassemia

Thalassemia is a genetic hemoglobin disorder. It affects the alpha or beta chains of the globin component of hemoglobin, resulting in ineffective erythropoiesis as well as hemolysis. This results in malfunctioning hemoglobin and varying degrees of hemolytic anemia, depending on disease severity **(Helmi et al., 2017)**.

1.2.2.1 Clinical and Radiographic Presentation

Patients with this condition typically present with maxillary protrusion, teeth spacing, and class II malocclusion due to enlargement of bone marrow cavity from bone marrow hyperplasia to compensate for anemia.

On radiographs, the mandibular cortical bone is notably thin. Patients also have a higher caries rate from reduced amounts of immunoglobulin A and phosphorous in saliva and may present with gingivitis if their spleen has been removed. Short teeth crowns and roots also frequently are noted radiographically. Patients with this condition also could present with burning mouth as a result of the anemia. Systemically, they present with splenomegaly, hepatomegaly, jaundice, and osteoporosis **(Hattab, 2017)**.

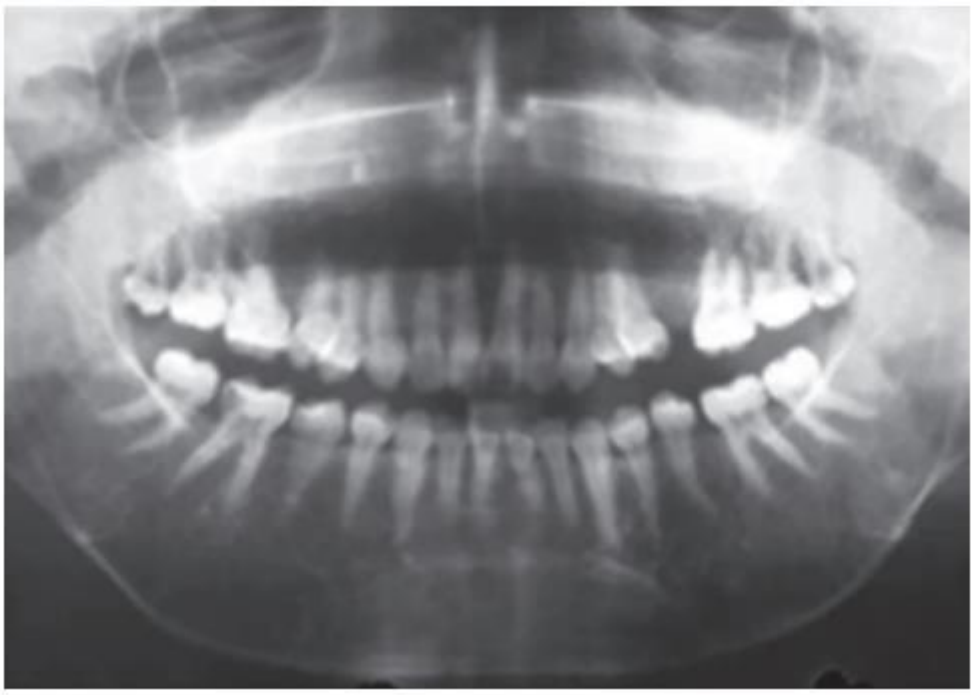

Figure 1-9: Panoramic radiograph of thalassemia patient demonstrating thinned mandibular inferior cortex, enlarged bone marrow spaces, short spiky roots of the mandibular molars, thin lamina dura, indiscernible border of the mandibular canal (Hattab, 2017)

1.3 Endocrine Disorders

1.3.1 HYPERPARATHYROIDISM

Definition: Hyperparathyroidism is an endocrine abnormality in which there is an excess of circulating parathyroid hormone (PTH). An excess of serum PTH increases bone remodeling in preference of osteoclastic resorption, which mobilizes calcium from the skeleton. In addition, PTH increases renal tubular reabsorption of calcium and renal production of the active vitamin D metabolite 1,25(OH)2D. The net result of these functions is in an increase in serum calcium levels. Primary hyperparathyroidism usually results from a benign tumor (adenoma) of one of the four parathyroid glands, resulting in the production of excess PTH. An abnormality named hyperparathyroidism – jaw tumor syndrome, which involves tumors of parathyroid glands, jaws, and kidneys, has been shown to have genetic basis. Less frequently, individuals may have hyperplastic parathyroid glands that secrete excess PTH. The combination of hypercalcemia and an elevated serum level of PTH is diagnostic of primary hyperparathyroidism. The incidence of primary hyperparathyroidism is about 0.1%. Secondary hyperparathyroidism results from a compensatory increase in the output of PTH in response to hypocalcemia. The underlying hypocalcemia may result from an inadequate dietary intake or poor intestinal absorption of vitamin D or from deficient metabolism of vitamin D in the liver or kidney. This condition produces clinical and radiographic effects similar to those of primary hyperparathyroidism **(Chanson and Salenave, 2008)**.

Radiographic Features of the Jaws. Demineralization and thinning of cortical boundaries often occur in the jaws in cortical boundaries such as the inferior border, mandibular canal, and the cortical outlines of the maxillary sinuses. The density of the jaws is decreased, resulting in a radiolucent appearance that contrasts with the density of the teeth. The

teeth stand out in contrast to the radiolucent jaws (Fig. 8). A change in the normal trabecular pattern may occur, resulting in a ground-glass appearance of numerous, small, randomly oriented trabeculae. Brown tumors of hyperparathyroidism may appear in any bone but are frequently found in the facial bones and jaws, particularly in long-standing cases of the disease. These lesions may be multiple within a single bone. They have variably defined margins and may produce cortical expansion. If solitary, the tumor may resemble a central giant cell granuloma or an aneurysmal bone cyst (Fig. 9). It is interesting to note that the histologic appearance of the brown tumor is identical to that of the giant cell granuloma. Therefore if a giant cell granuloma occurs later than the second decade, the patient should be screened for an increase in serum calcium, PTH, and alkaline phosphatase levels **(Stuart, 2009)**.

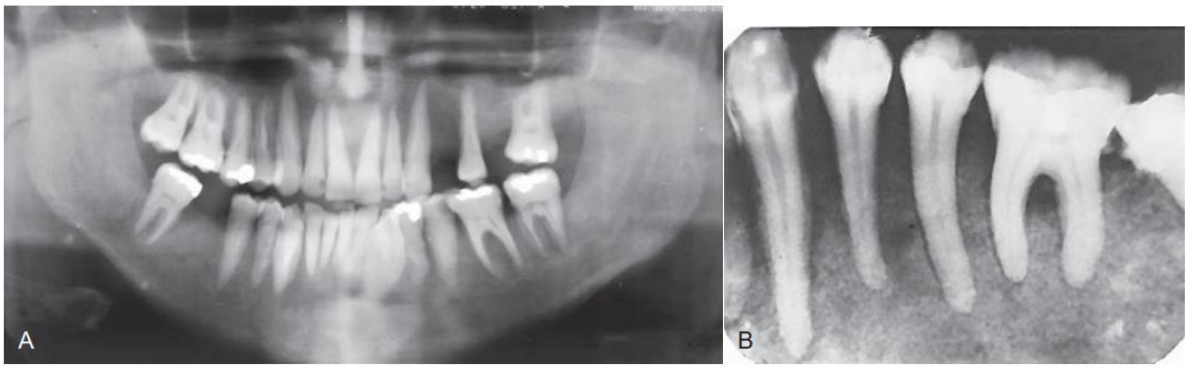

Figure 1-10: A, Panoramic image. The loss of bone in hyperparathyroidism results in the radiopaque teeth standing out in contrast to the radiolucent jaws. B, Note the loss of a distinct lamina dura and the granular texture of the bone pattern in this periapical film of a different case (Stuart, 2009)

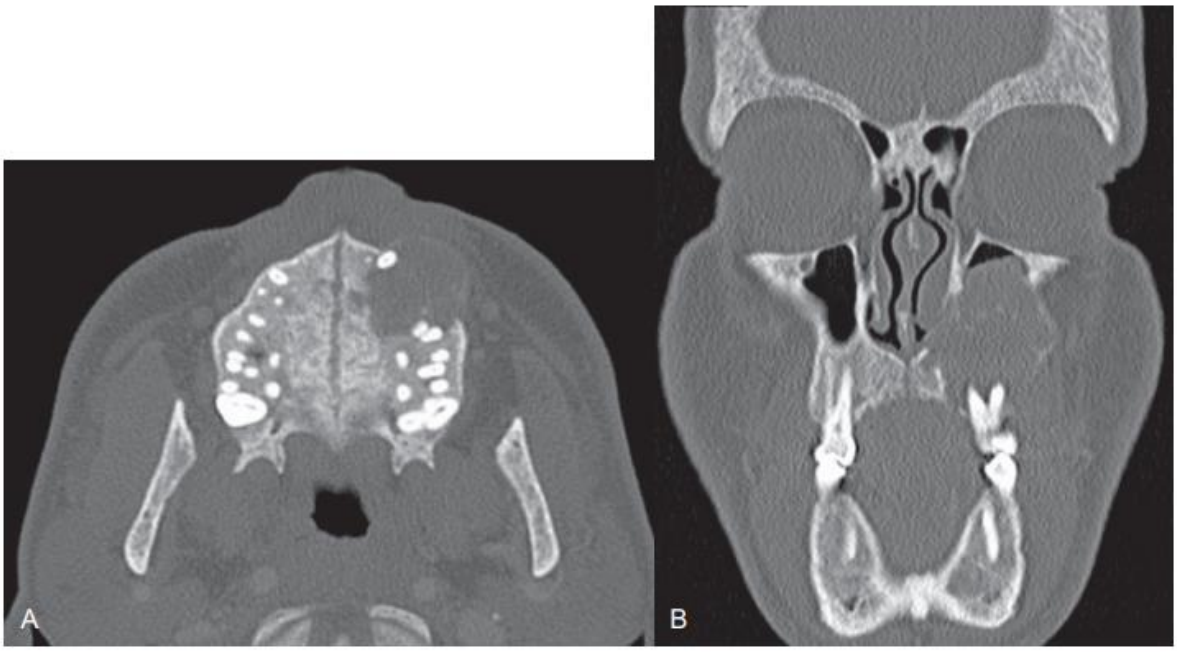

Figure 1-11: A, Axial and, B, coronal computed tomographic images with bone algorithm of a case of secondary hyperparathyroidism with a brown tumor involving the maxilla. This tumor has features of a central giant cell granuloma with a granular expanded cortex of the maxilla and very subtle and ill-defined internal septa (Stuart, 2009).

1.3.2 HYPOPARATHYROIDISM

Hypoparathyroidism is an uncommon condition in which insufficient secretion of PTH occurs. Several causes exist, but the most common is damage or removal of the parathyroid glands during thyroid surgery. In pseudohypoparathyroidism there is a defect in the response of the tissue target cells to normal levels of PTH **(Nora et al., 2004)**.

Clinical Features: Both hypoparathyroidism and pseudohypoparathyroidism produce hypocalcemia, which has a variety of clinical manifestations. Most often this includes sharp flexion (tetany) of the wrist and ankle joints (carpopedal spasm). Some patients have sensory abnormalities consisting of paresthesia of the hands, feet, or the area

around the mouth. Neurologic changes may include anxiety and depression, epilepsy, parkinsonism, and chorea. Chronic forms may produce a reduction in intellectual capacity. Some patients show no changes at all. Patients with pseudohypoparathyroidism often have early closure of certain bony epiphyses and thus manifest short stature or extremity disproportions **(Hejlesen et al., 2018)**.

Radiographic Features: The principal radiographic change is calcification of the basal ganglia. On skull radiographs this calcification appears flocculent and paired within the cerebral hemispheres on the posteroanterior view. Radiographic examination of the jaws may reveal dental enamel hypoplasia, external root resorption, delayed eruption, or root dilaceration (Fig. 10) **(Srirangarajan et al., 2014)**

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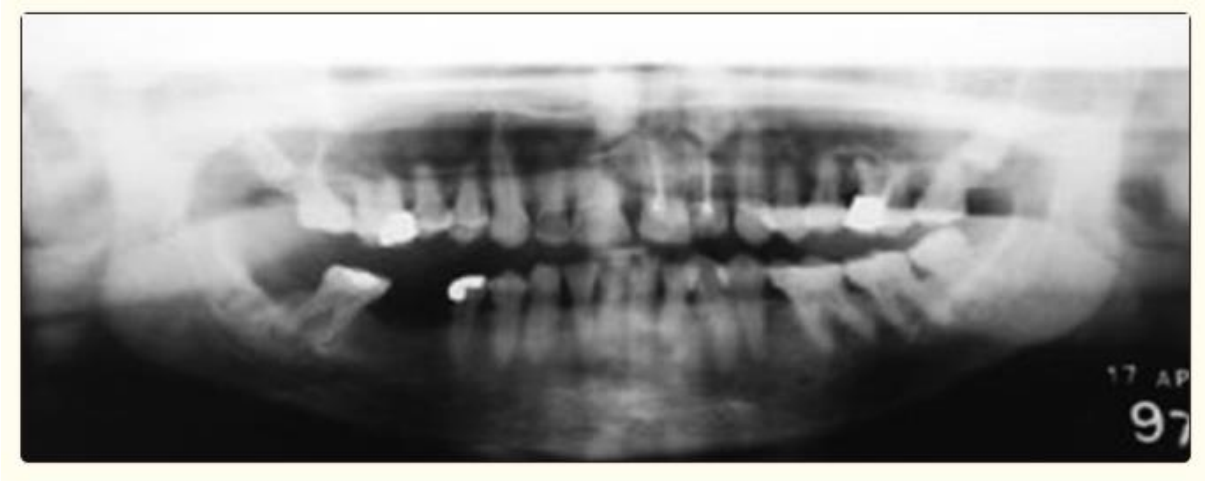

Figure 1-12: Orthopantomogram of primary hypoparathyroidism (Srirangarajan et al., 2014)

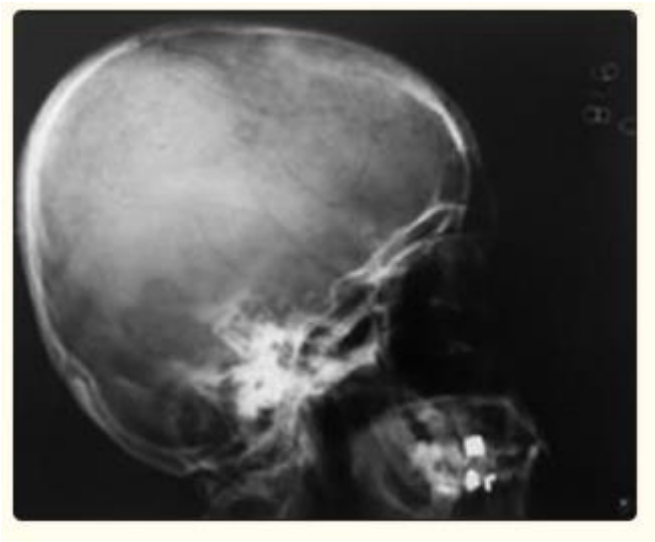

Figure 1-13: Lateral cephalogram of primary hypoparathyroidism (Srirangarajan et al., 2014)

1.3.3 HYPERPITUITARISM

Hyperpituitarism results from hyperfunction of the anterior lobe of the pituitary gland, which increases the production of growth hormone. An excess of growth hormone causes overgrowth of all tissues in the body still capable of growth. The usual cause of this problem is a benign functioning tumor of the acidophilic cells in the anterior lobe of the pituitary gland **(Bandgar et al., 2010)**.

1.3.3.1 Clinical and radiographic features

Hyperpituitarism in children involves generalized overgrowth of most hard and soft tissues, a condition termed giantism. Active growth occurs in those bones in which the epiphyses have not united with the bone shafts. Throughout adolescence, generalized skeletal growth is excessive and may be prolonged. Those affected may ultimately attain heights of 7 to 8 feet or more, yet exhibit remarkably normal proportions. The eyes and other parts of the central nervous system do not enlarge, except in rare cases in which the condition is manifested in infancy. Hyperpituitarism causes

enlargement of the jaws, most notably the mandible (Fig. 1-14). The increase in the length of the dental arches results in spacing of the teeth. In acromegaly the angle between the ramus and body of the mandible may increase. This, in combination with enlargement of the tongue (macroglossia), may result in anterior flaring of the teeth and the development of an anterior open bite. The sign of incisor flaring is a helpful point of differentiation between acromegalic prognathism and inherited prognathism. In acromegaly the most profound growth occurs in the condyle and ramus, often resulting in a class III skeletal relationship between the jaws. The thickness and height of the alveolar processes may also increase **(Kaur et al., 2012).**

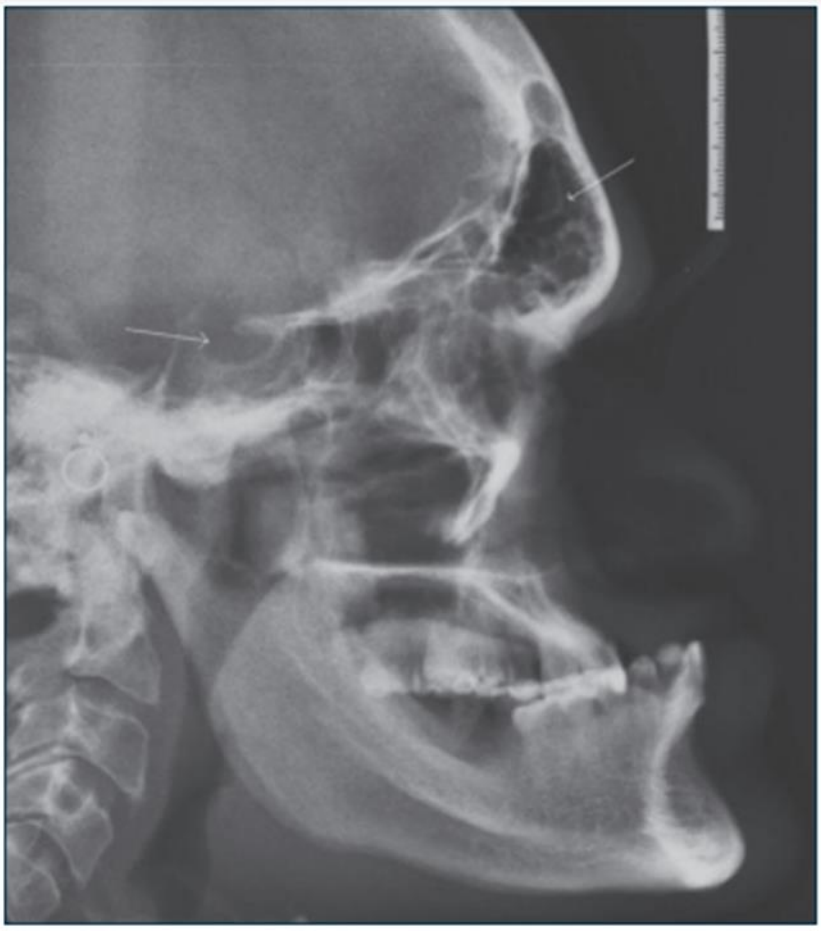

Figure 1-14: Lateral cephalogram showing enlarged sella turcica, paranasal sinuses and mandible (Kaur et al., 2012)

1.3.4 HYPOPITUITARISM

Hypopituitarism results from reduced secretion of pituitary hormones. Individuals with this condition show dwarfism but have relatively well-proportioned bodies. One study reported a marked failure of development of the maxilla and the mandible. The dimensions of these bones in adults with this disorder were approximately those of normal children 5 to 7 years of age. In pituitary dwarfism there may be various anomalies of the dental apparatus, from the morphological profile and in terms of development. The clinical picture presents aspects of hypodontia, delayed tooth eruption, abnormalities of tooth shape and size, and double or impacted teeth **(Ferrante et al., 2017)**.

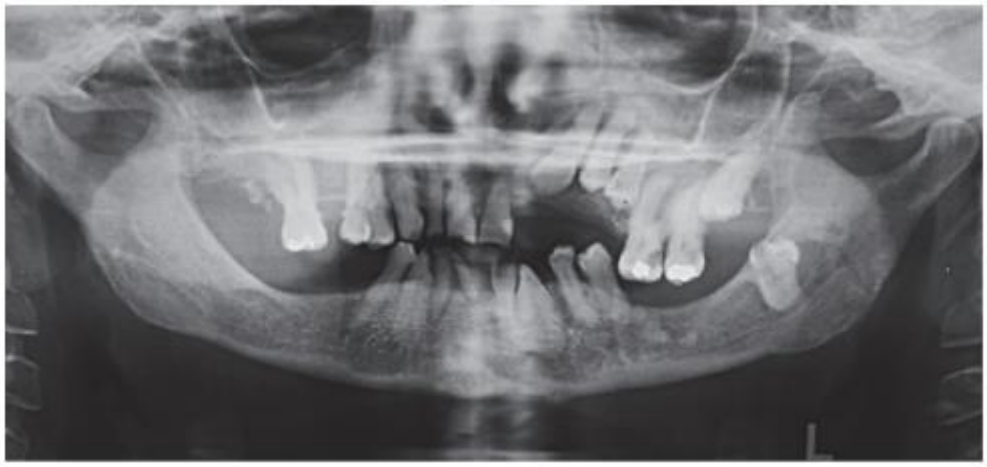

Figure 1-15: Orthopantomography revealed multiple dental anomalies: hypodontia, radicular fusion of 3.2–3.3, and impacted permanent teeth. (Ferrante et al., 2017)

1.3.5 Hypothyroidism

Hypothyroidism usually results from insufficient secretion of thyroxine by the thyroid glands despite the presence of thyroid-stimulating hormone. Clinical Features In children, hypothyroidism may result in retarded mental and physical development. The base of the skull shows delayed

ossification, and the paranasal sinuses only partially pneumatize. Dental development is delayed, and the primary teeth are slow to exfoliate. Hypothyroidism in the adult results in myxedematous swelling but not the dental or skeletal changes seen in children. Adult symptoms may range from lethargy, poor memory, inability to concentrate, constipation, and cold intolerance to the more florid clinical picture of dull and expressionless face, periorbital edema, large tongue, sparse hair, and skin that feels "doughy" to the touch. Radiographic Features Radiographic features in children include delayed closing of the epiphyses and skull sutures with the production of numerous wormian bones (accessory bones in the sutures). Effects on the teeth include delayed eruption, short roots, and thinning of the lamina dura. The maxilla and mandible are relatively small. Patients with adult hypothyroidism may show periodontal disease, loss of teeth, separation of teeth as a result of enlargement of the tongue, and external root resorption **(Chandna and Bathla, 2011)**.

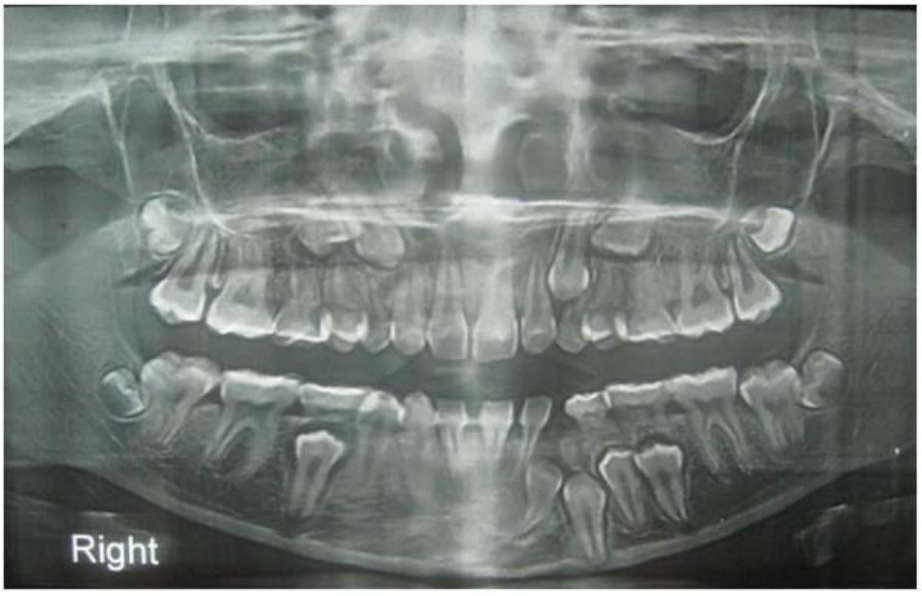

Figure 1-16: OPG showing multiple unerupted permanent teeth (Gupta et al., 2014)

1.3.6 CUSHING' S SYNDROME

Cushing' s syndrome arises from an excess of secretion of glucocorticoids by the adrenal glands. This may result from any of the following: 1. An adrenal adenoma 2. An adrenal carcinoma 3. Adrenal hyperplasia (usually bilateral) 4. A basophilic adenoma of the anterior lobe of the pituitary gland (Cushing' s disease), producing excess adrenocorticotropic hormone 5. Medical therapy with exogenous corticosteroids The increased level of glucocorticoid results in a loss of bone mass from reduced osteoblastic function and either directly or indirectly increased osteoclastic function **(Yousaf et al., 2015)**.

Clinical Features: Patients with Cushing' s syndrome often show obesity (which spares the extremities), kyphosis of the thoracic spine ("buffalo hump"), weakness, hypertension, striae, or concurrent diabetes. This condition affects females three to five times as frequently as males. Onset may occur at any age but is usually seen in the third or fourth decade.

Radiographic Features: The primary radiographic feature of Cushing' s syndrome is generalized osteoporosis, which may have a granular bone pattern. This demineralization may result in pathologic fractures. The skull can show diffuse thinning accompanied by a mottled appearance. The teeth may erupt prematurely, and partial loss of the lamina dura may occur (Fig. 12) **(Stuart, 2009)**.

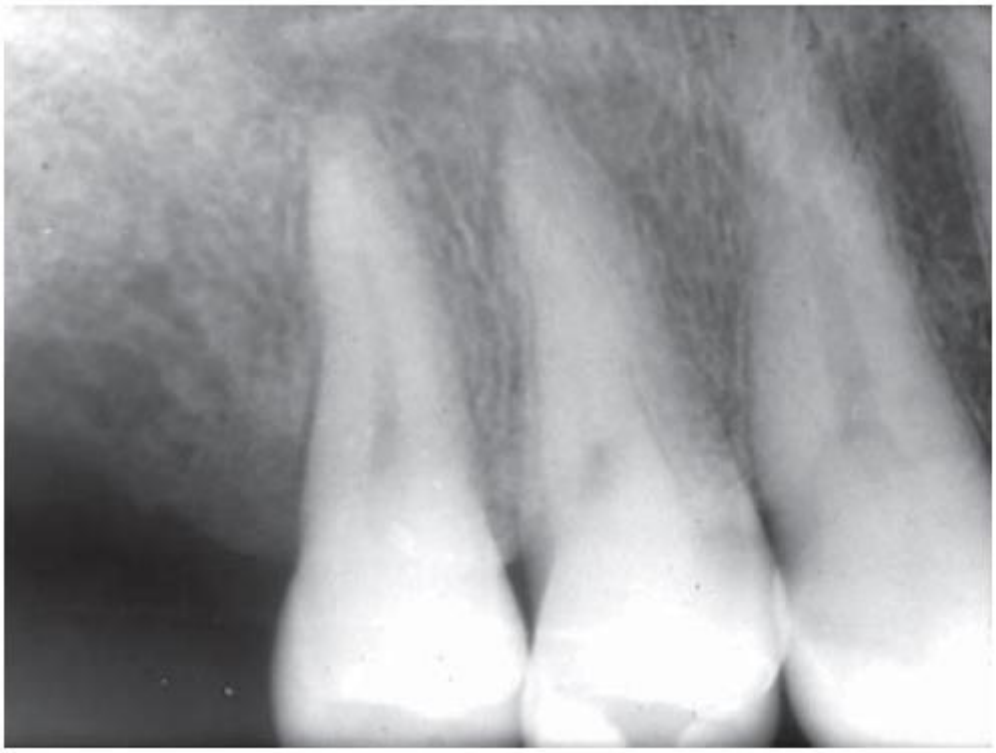

Figure 1-17: Cushing' s syndrome manifested in the jaws as thinning of the lamina dura. (Stuart, 2009)

Chapter 2

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previous studies

Chapter two: previous studies

2.1 Prediction of osteoporosis using dental radiographs and age in females

A prospective study in 2015 was conducted in the Department of Oral Medicine and Radiology at Al-Badar Dental College and Hospital; the study group consisted of 50 female patients between the age group of 40 and 60 years. All the patients were subjected to digital radiography and tracing were done. After the radiographic diagnosis all the patients were subjected for bone mineral density (BMD) using quantitative ultrasound (QUS) for confirming the radiographic diagnosis. Out of 50 female patients according to radiomorphometric indices (RMI), maximum number of osteoporotic patients was found in the age group of 40 to 45 years that comprises 17 patients and out of them nine (52.94%) were diagnosed as osteoporotic. According to QUS, maximum number of osteoporotic patients was found in the age group of 46 to 50 years, that comprises 16 and of which eight (50%) were identified as osteoporotic. For all the age groups, total osteoporotic patients identified by RMI were 29 (58%); BMD has confirmed 23 (46%) as osteoporotic and 6 (12%) as osteopenic. Accordingly the overall sensitivity of dental radiograph is 0.75 or 75% and specificity is 0.81 or 81%. Statistical value or p value was found to be consistently > 0.05, which is not significant in all the age groups that is, from 40 to 60 years that shows that sensitivity and specificity is not affected with advancing age **(Vijay et al., 2015)**.

2.2 Fibrous dysplasia—a 13-year retrospective radiographic analysis

Nityasri et al in 2011 conducted a retrospective study using the clinical file records and radiographs of the patients who reported to the outpatient clinic in the Department of Oral Medicine and Radiology in Government Dental College, 24 cases were retrospectively reviewed for histopathologically diagnosed fibrous dysplasia. A detailed analysis of the clinical and radiographic features of the 24 cases retrieved was carried out. The male-to-female ratio of incidence was

approximately 1:1. Most of the patients were in the second or third decade of life. Almost all the patients presented with a complaint of swelling on the side of the face. The mandible was more frequently involved than the maxilla. The most common radiographic pattern observed was the ‘‘ground-glass’’ appearance. Most of the patients exhibited expansion of the involved bone and loss of lamina dura of associated teeth **(Nityasri et al., 2011)**.

Chapter three: Conclusion

Disorders of the endocrine system, bone metabolism, and other systemic diseases may have an effect on the form and function of bone and teeth. The function of bone not only includes support, protection, and an environment for hemopoiesis but also serves as a major reserve of calcium for the body. More than 99% of the total body calcium is contained within the skeletal structure. When the influence of systemic conditions on the jaws is considered, it is important to bear in mind that bone is constantly remodeling.

The dentist should be capable of detecting features of systemic diseases when they produce changes on radiographs. Such conditions can have a major impact on the quality of life of afflicted patients. Early detection can lead to appropriate treatment and alleviation of untoward side effects.

Dental radiographs can alert clinicians to changes in hard and soft tissues. In children, radiographs allow the clinician to see how teeth and jawbones are developing. Dental radiographs can help identify diseases and developmental problems before they become serious health issues. Early detection of systemic diseases and conditions also can limit or prevent further damage to the patient.

References

(A)

- Ahmad, M. and Gaalaas, L., 2018. Fibro-osseous and other lesions of bone in the jaws. *Radiologic Clinics*, *56*(1), pp.91-104.
- Akintoye, S.O., Boyce, A.M. and Collins, M.T., 2013. Dental perspectives in fibrous dysplasia and McCune–Albright syndrome. *Oral surgery, oral medicine, oral pathology and oral radiology*, *116*(3), pp.e149-e155.
- Akintoye, S.O., Otis, L.L., Atkinson, J.C., Brahim, J., Kushner, H., Robey, P.G. and Collins, M.T., 2004. Analyses of variable panoramic radiographic characteristics of maxillo-mandibular fibrous dysplasia in McCune–Albright syndrome. *Oral diseases*, *10*(1), pp.36-43.

(B)

- Bandgar, T.R., Sarathi, V., Shivane, V., Bansode, N., Menon, P.S. and Shah, N.S., 2010. The value of an acute octreotide suppression test in predicting response to long-term somatostatin analogue therapy in patients with acromegaly. *Journal of Postgraduate Medicine*, *56*(1), p.7.
- Bender, I.B., 2003. Paget's disease. *Journal of endodontics*, *29*(11), pp.720-723.
- Bianco, P., Riminucci, M., Majolagbe, A., Kuznetsov, S.A., Collins, M.T., Mankani, M.H., Corsi, A., Bone, H.G., Wientroub, S., Spiegel, A.M. and Fisher, L.W., 2000. Mutations of the GNAS1 gene, stromal cell dysfunction, and osteomalacic changes in non–McCune–Albright fibrous dysplasia of bone. *Journal of Bone and Mineral Research*, *15*(1), pp.120-128.
- Burke, A.B., Collins, M.T. and Boyce, A.M., 2017. Fibrous dysplasia of bone: craniofacial and dental implications. *Oral diseases*, *23*(6), pp.697-708.

(C)

- Chandna, S. and Bathla, M., 2011. Oral manifestations of thyroid disorders and its management. *Indian journal of endocrinology and metabolism*, *15*(Suppl2), p.S113.
- Chanson, P. and Salenave, S., 2008. Acromegaly. *Orphanet journal of rare diseases*, *3*(1), pp.1-17.
- Collins, M.T., Chebli, C., Jones, J., Kushner, H., Consugar, M., Rinaldo, P., Wientroub, S., Bianco, P. and Robey, P.G., 2001. Renal phosphate wasting in fibrous dysplasia of bone is part of a generalized renal tubular dysfunction similar to that seen in tumor-induced osteomalacia. *Journal of Bone and Mineral Research*, *16*(5), pp.806-813.

(D)

- De Castro, J.G.K., Carvalho, B.F., de Melo, N.S., de Souza Figueiredo, P.T., Moreira-Mesquita, C.R., de Faria Vasconcelos, K., Jacobs, R. and Leite, A.F., 2020. A new cone-beam computed tomography–driven index for osteoporosis prediction. *Clinical Oral Investigations*, *24*, pp.3193-3202.
- De Luna G, Ranque B, Courbebaisse M, et al. 2018. High bone mineral density in sickle cell disease: prevalence and characteristics. Bone 110:199-203.
- Dos Santos, B., Koth, V.S., Figueiredo, M.A., Salum, F.G. and Cherubini, K., 2018. Brown tumor of the jaws as a manifestation of tertiary hyperparathyroidism: A literature review and case report. *Special care in dentistry*, *38*(3), pp.163-171.

(F)

- Ferrante, F., Blasi, S., Crippa, R. and Angiero, F., 2017. Dental abnormalities in pituitary dwarfism: a case report and review of the literature. *Case reports in dentistry*, *2017*.

- Foster, 2014. Rare bone diseases and their dental, oral, and craniofacial manifestations. *Journal of dental research*, *93*(7_suppl), pp.7S-19S.

(G)

- Ghapanchi, J., Zahed, M., Haghnegahdar, A., Niakan, N. and Sadeghzadeh, A., 2018. Osteoporosis and jaw abnormalities in panoramic radiography of chronic liver failure patients. *BioMed research international*, *2018*.
- Giro, G., Chambrone, L., Goldstein, A., Rodrigues, J.A., Zenóbio, E., Feres, M., Figueiredo, L.C., Cassoni, A. and Shibli, J.A., 2015. Impact of osteoporosis in dental implants: a systematic review. *World journal of orthopedics*, *6*(2), p.311.
- Gupta, R., Goel, K., Solanki, J. and Gupta, S., 2014. Oral manifestations of hypothyroidism: a case report. *Journal of clinical and diagnostic research: JCDR*, *8*(5), p.ZD20.

(H)

- Hattab, F.N., 2017. Thalassemia major and related dentomaxillofacial complications: Clinical and radiographic overview with reference to dental care. *Int J Exp Dent Sci*, *6*(2), pp.95-104.
- Hejlesen, J., Underbjerg, L., Gjørup, H., Bloch-Zupan, A., Sikjaer, T., Rejnmark, L. and Haubek, D., 2018. Dental findings in patients with non-surgical hypoparathyroidism and pseudohypoparathyroidism: a systematic review. *Frontiers in Physiology*, *9*, p.701.
- Helmi, N., Bashir, M., Shireen, A. and Ahmed, I.M., 2017. Thalassemia review: features, dental considerations and management. *Electronic physician*, *9*(3), p.4003.

(K)

- Kaur, M., Shailaja, S., Chandra, S., & Mamatha, B., 2012. Acromegaly — A Case Report with Dentist's Perspectives and Review of Literature. *Journal of Academy of Advanced Dental Research, 3*, 11 - 14.

- Ko, E., Omolehinwa, T., Akintoye, S.O. and Mupparapu, M., 2021. Radiographic diagnosis of systemic diseases manifested in jaws. *Dental Clinics*, *65*(3), pp.579-604.

(M)

- Mundlos, S., 1999. Cleidocranial dysplasia: clinical and molecular genetics. *Journal of medical genetics*, *36*(3), pp.177-182.

(N)

- Nityasri, V., Haris, P.S., Bose, T. and Balan, A., 2011. Fibrous dysplasia—a 13-year retrospective radiographic analysis in a south Indian population. *Dentomaxillofacial Radiology*, *40*(5), pp.282-289.
- Nityasri, V., Haris, P.S., Bose, T. and Balan, A., 2011. Fibrous dysplasia—a 13-year retrospective radiographic analysis in a south Indian population. *Dentomaxillofacial Radiology*, *40*(5), pp.282-289.
- Nora, D.B., Fricke, D., Becker, J. and Gomes, I., 2004. Hypocalcemic myopathy without tetany due to idiopathic hypoparathyroidism: case report. *Arquivos de Neuro-Psiquiatria*, *62*, pp.154-157.

(P)

- Papadaki, M.E., Lietman, S.A., Levine, M.A., Olsen, B.R., Kaban, L.B. and Reichenberger, E.J., 2012. Cherubism: best clinical practice. *Orphanet journal of rare diseases*, *7*(1), pp.1-14.
- Parentin, F. and Perissutti, P., 2003. Solitary median maxillary central incisor, Duane retraction syndrome, growth hormone deficiency and duplicated thumb phalanx: a case report. *Clinical dysmorphology*, *12*(2), pp.141-142.
- Pauwels, R., Jacobs, R., Singer, S.R. and Mupparapu, M., 2015. CBCT-based bone quality assessment: are Hounsfield units applicable? *Dentomaxillofacial Radiology*, *44*(1), p.20140238.

- Pereira, T.D.S.F., Gomes, C.C., Brennan, P.A., Fonseca, F.P. and Gomez, R.S., 2019. Fibrous dysplasia of the jaws: Integrating molecular pathogenesis with clinical, radiological, and histopathological features. *Journal of Oral Pathology & Medicine*, *48*(1), pp.3-9.

(R)

- Reichenberger, E.J., Levine, M.A., Olsen, B.R., Papadaki, M.E. and Lietman, S.A., 2012. The role of SH3BP2 in the pathophysiology of cherubism. *Orphanet Journal of Rare Diseases*, *7*(1), pp.1-12.

(S)

- Srirangarajan, S., Satyanarayan, A., Ravindra, S., & Thakur, S. (2014). Dental manifestation of primary idiopathic hypoparathyroidism. *Journal of Indian Society of Periodontology*, *18*(4), 524–526.
- Stuart C. White., 2009. Oral Radiology: Principles and Interpretation 6th edition. *A Divisionof Reed Elsevier India Pvt Limited*., pp 428-473

(T)

- Theodorou, D.J., Theodorou, S.J. and Kakitsubata, Y., 2011. Imaging of Paget disease of bone and its musculoskeletal complications. *American Journal of Roentgenology*, *196*(6_supplement), pp.S64-S75.

(V)

- Vijay, G., Chitroda, P.K., Katti, G., Shahbaz, S. and Baba, I., 2015. Prediction of osteoporosis using dental radiographs and age in females. *Journal of mid-life health*, *6*(2), p.70.

(W)

- Watanabe, P. C. A., E. S. Arita, S. A. C. Monteiro, T. M. Oliveira, and A. Taguchi. "Relationship among three indicators of bone quality in the

osteoporosis research on panoramic radiographic." In *OSTEOPOROSIS INTERNATIONAL*, vol. 15, pp. S67-S67. SWEETAPPLE HOUSE CATTESHALL ROAD, GODALMING GU7 3DJ, SURREY, ENGLAND: SPRINGER LONDON LTD, 2004.

- White, S.C., Atchison, K.A., Gornbein, J.A., Nattiv, A., Paganini-Hill, A., Service, S.K. and Yoon, D.C., 2005. Change in mandibular trabecular pattern and hip fracture rate in elderly women. *Dentomaxillofacial Radiology*, *34*(3), pp.168-174.

(Y)

- Yousaf, E., Niazi, M., Malik, N. and Farooq, M.A., 2015. Adrenocortical Tumor with Endogenous Cushing Syndrome in a Child. *Journal of Islamabad Medical & Dental College (JIMDC)*, *4*(2), pp.91-92.