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Chapter
Perspective Chapter: Parathyroid Glands in Dentistry
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Abstract

Parathyroid glands are found adjacent to the thyroid, produce parathyroid hormone, and regulate with their function serum calcium levels. Parathyroid conditions are encountered in dentistry as in other health sciences. In dentistry, however, since they are not so frequently observed or encountered they are often not diagnosed, or not identified. Many patients, though they have a known history of parathyroid gland disorders or conditions, often neglect to mention it to the dentist, or in many cases the dentist omits it in the medical history section, and since in most cases they are often unaware of the dental findings, the conditions and malfunction of the glands may clinically present at patients. The dentists and medical practitioners should note in those patients, in cases of hyperparathyroidism possible brown tumors of the jaws, and in cases of hypothyroidism short stature, developmental disturbances, teeth development disturbances, etc. In this chapter, the major findings of the disorders of parathyroid glands are noted and reported as well as thoroughly described with clinical and dental radiographic findings of the conditions.

Keywords: dentistry, parathyroid glands, hyperparathyroidism, hypoparathyroidism, brown tumor

1. Introduction

Parathyroid hormone is produced by the parathyroid glands and has a key role in bone formation. These glands control the amount of calcium in our blood. Everyone has four parathyroid glands, usually located right around and behind the thyroid gland at the base of the neck. They are about the size of a grain of rice. These small glands produce parathyroid hormone, regulating calcium levels [1].

2. Hyperparathyroidism

The percentage of developing some type of parathyroid gland tumor in adult people is about 1%. In most cases, the tumor or the condition will cause “hyperparathyroidism” [2]. The condition is aggressive and causes high blood calcium levels, which can lead to serious health problems. It presents when the parathyroid glands create too much parathyroid hormone in the bloodstream. Hyperparathyroidism (HPT) may be primary, secondary, and tertiary type and is featured as overproduction of parathyroid hormone.
Primary hyperparathyroidism [2] may be cured by removing the adenoma or over-active parathyroid glands [3, 4]. In those without symptoms, mildly increased blood calcium levels, normal kidneys, and normal bone density monitoring may be all that is required. The deficiency of vitamin D with low serum levels should be corrected. The case of primary hyperparathyroidism is the most common type. In the developed world, the number of people affected is estimated, between one and four per thousand people. The condition occurs three times more often in women than men and is typically diagnosed between the ages of 50 and 60. Radiation exposure increases the risk of primary hyperparathyroidism. Several genetic conditions including multiple endocrine neoplasia syndromes also increase the risk [4].

In other cases of secondary hyperparathyroidism, what usually happens is the following: In patients with chronic kidney disease (CKD), impaired renal function leads to decreased vitamin D levels, which in turn causes an increase in parathyroid hormone production and contributes to the development of secondary hyperparathyroidism. The low levels of vitamin D lead to reduced calcium absorption by the intestine thus resulting in hypocalcemia and increased parathyroid hormone level secretion. This in turn leads to an increase in bone resorption. When the bone condition is caused by kidney failure in the case of secondary hyperparathyroidism, the pathology is termed renal osteodystrophy [5, 6].

Long-term secondary hyperparathyroidism, which eventually leads to hyperplasia of the parathyroid glands, can lead in a number of cases to tertiary hyperparathyroidism, which leads to a loss of response to serum calcium levels [5, 6].

In dentistry, the most frequent presentation of hyperparathyroidism is a brown tumor [5–8]. The brown tumor is a bone lesion that arises in settings of excess osteoclastic activity, such as hyperparathyroidism. The brown tumor (BT) or osteitis fibrosa cystica is a benign osseous lesion, which may result in any form of uncontrolled parathyroid hormone hypersecretion [7]. These non-neoplastic lesions present late in the untreated disease have been severely decreased by early diagnosis and successful management of hyperparathyroidism in developed countries [7, 8].

Diagnosis of brown tumors is merely presumptive, and in most cases in the jaws, it presents as an incidental finding. Histology sets the final diagnosis. Laboratory data and radiographs may be additionally used for definitive clinical diagnosis. In a radiographical examination, there are findings from the bones that can even aid the diagnosis of the condition in a large number of patients.

Brown tumor may show no changes or a generalized osteoporosis image, making it difficult to diagnose. The lesions present as sharply defined, round, or oval radiolucent areas, which may appear as multilocular (Figure 1). It is useful to know the serum levels of calcium and parathyroid hormone to set the differential diagnosis from giant cell lesions [8].

In hyperparathyroidism, serum parathyroid hormone level can be indicative of the diagnosis of the brown tumor, when compared with other giant cell tumors. In a rare case published by our clinic, the patient’s panoramic radiography that was taken 2 years ago (Figure 2) showed a very early lesion with no well-defined radiolucent osteolytic lesions near the middle section of the teeth roots. In the later panoramic radiograph of the patient, the lesion had progressed to a well-defined lucency adjacent to the tooth’s roots extending to the surrounding bone. The lesion was removed regionally, and the systemic management revolved primarily in reducing circulating endocrine hormone (parathyroid hormone) [9].

What should be noted in this case is that in the first panoramic radiograph though, there was some indication that the diagnosis could not have been set from
the radiographic image. Similar cases have been dealt accordingly with no need for further medical management. Parathyroidectomy is the treatment of choice. In our case, the brown tumor of the mandible was the first sign of the condition (hyperparathyroidism) due to imbalance of osteoblastic and osteoclastic activities, formed by increased parathyroid hormone levels and calcium phosphorous serum level regulation. Upon re-examining the patient, there was no recurrence of the lesion or presence of other similar lesions [9].
Our case had the unusual primary detection of the condition in the mandible. Clinically, there was mild swelling in the region and hardly any pain upon palpation of the lesion (Figure 3). It is a rare case but should alert radiologists, and one should be careful of the medical history of a patient even upon taking a plain radiograph. The differential diagnosis should be set, only after a thorough study of the patient’s both medical and dental history. Dentists should be aware of the medical conditions that may cause dental problems and should be more alert to certain patients.

In conclusion, the development of brown tumors in the jaws is not one of the common findings of the disease [10]. At the clinical level, the brown tumor initially appears as a hard bone-like tumor, which shows very slow growth. Later, when the tumor erodes the cortical bone marrow, a change in its texture is observed. At a radiological level, in classical radiographs the brown tumors are depicted as single-chambered or multi-chambered, usually mixed (shading and clarifying) lesions [11–13].

3. Hypoparathyroidism

Besides hyperparathyroidism that is the most frequently produced parathyroid gland malfunction, there is a rare and more misdiagnosed case of hypoparathyroidism. Hypoparathyroidism is decreased function of the parathyroid glands, with underproduction of parathyroid hormone. This can lead to low levels of calcium in the blood, often causing cramps and twitching of muscles or even in more advanced cases together with other symptoms. Hypoparathyroidism is a very rare condition that can be inherited, but can also present itself after thyroid or parathyroid gland surgery, and can be caused by immune system-related damage as well as several rarer causes [14–16].

Hypoparathyroidism does not represent one condition but rather a group of diseases characterized by hypocalcemia and hyperphosphatemia clinically. Basically, the result and clinical measurements set the diagnosis. These disorders that can present as
hypoparathyroidism can be the result of either reduced or damaged secretion of parathyroid hormone by the parathyroid gland or failure of the target organs to respond to the hormone properly. In the last described case where the cause is not the gland itself, the condition is known as pseudohypoparathyroidism (PHP) and is associated with an elevated plasma concentration of parathyroid hormone (not originating from glandular malfunction) [14]. Fuller Albright described the first patients with this disorder in 1942, and the condition took his name and is described as Albright condition. The patients with the condition demonstrate phenotypical features that include a round face, short stature, obesity, brachyactly, and ectopic calcifications. The features of the condition are typically found in patients with type Ia PHP, also known as Albright hereditary osteodystrophy [14–17].

Distinction between type I and type II PHP is based on the response of cyclic adenosine monophosphate (cAMP) to parathyroid hormone, which is abnormal in type I and normal in type II. These metabolic abnormalities are very rare, with a reported prevalence of only 0.79 per 100,000 individuals [18].

The major features and classical to the condition findings include a high parathormone serum concentration, high serum phosphate, and low serum calcium concentrations, all caused by the existing end-organ resistance.

Patients with PHP may or may not have the clinical features of type I of the disease, such as short stature, rounded face, and central obesity [19, 20] though in most cases they present with symptoms indicative of electrolyte disturbances (Ca and P levels). Imaging features mainly reflect abnormalities in the musculoskeletal and central nervous systems. The lateral cephalogram of the patients demonstrates the hypoplasia of the jaws (Figure 4). Computed tomography of the central nervous system in the condition usually reveals calcifications in the basal ganglia, specifically in the striatopallidal nuclei. Magnetic resonance imaging as it better displays the soft tissues [19], it may represent an even more sensitive modality helping in the early detection of clinical and radiographic changes in the basal ganglia.

PHP is a condition limited to only a few cases reported in the dental literature since it is a very rare condition [21].

In a rare case in our clinic, in the panoramic radiograph of the patient (Figure 5), there were multiple impactions of teeth with malformation of their development with mostly short roots and unusual shape. In the cone beam-computed tomography (CBCT) that was taken, the findings of PHP were thoroughly studied. Besides, the multiple impactions and the shape of the teeth calcifications of the basal ganglia were observed as an incidental finding [22]. Given the rarity of the disease and the limited literature, radiologists and dentists should be aware of the value of CBCT in the identification of incidental findings such as calcifications in the basal ganglia, which should always be reported. Only few case reports articles are present in the literature under the query “PHP and teeth,” and of those, only one paper was based on the presentation of four cases, and it is the one that provides a thorough description of the dental findings of the condition [23–27]. The initial description of the teeth deformities and malformations in patients with PHP occurred in 1952 by Mackler et al., who noted numerous unerupted teeth in medially PHP patients [28]. Although in the medical literature there are numerous studies of the condition including a large number of cases of PHP, there are very few references to the associated changes that occur in the dental tissues and facial development, since the jaws are often neglected in the clinical examination of the patients and also because in most cases, there are more serious issues to be addressed and prioritized. We also have to take into consideration that with the recent advances in medicine, PHP is
Parathyroid Glands - New Aspects

being diagnosed early in larger numbers of patients, even before reaching adulthood and completing their skeletal growth; however, only three case reports have been published since the year 2000.

The condition though it is very rare it should be taken into account when there is a known medical condition or symptoms present and not be excluded from the differential diagnosis of the patient’s pathosis [29].

In conclusion, dental findings of the condition include short roots with blunt ends, and small crowns, thin enamel, and large pulp chambers, many impacted or not properly erupted teeth, early teeth loss due to caries, and short and wide jaws with hypoplasia of both upper and lower jaw as well as the entire facial skeleton. When a number of those are present, the dentist should be alert to the possibility of the condition [23–30]. Though the diagnosis of PHP is based on laboratory findings of the patient, the dental findings should not be neglected.

4. Conclusions

Parathyroid glands are often causing various hormonal disorders and problems. The dentists should be fully alert to the conditions caused by parathyroid disorders
and bear in mind the medical history of the patients. Besides the medical history of the patients, a detailed and thorough clinical examination may reveal pathologies that involve parathyroid hormone disorders. The evaluation of clinical and radiological pathological findings by the dentist can lead to the diagnosis of systemic diseases. The dentist may even set the first diagnosis of the systemic disease.

Conflict of interest

The authors declare no conflict of interest.

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