Review Article

Odontoma - A brief overview

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Abstract

Odontoma is primarily diagnosed in children and adolescents with no gender predilection. It has been reported to be the most common of all odontogenic neoplasms and tumor-like lesions. Although the odontoma’s etiology remains unknown, patients have often reported a history of trauma and infection. In most cases, odontomas are asymptomatic characterized by a relatively slow growth and rarely exceeding the size of a tooth. In rare cases, odontomas exceed their usual dimensions resulting in the expansion of the cortical bone. Although odontomas may be diagnosed during any age, they are most frequently reported before the second decade of life. The present review summarizes the major clinicopathological characteristics and molecular pathogenesis of odontoma.

Keywords

Hamartomatous malformations, odontoma compound and complex, odontogenic tumor

Etiology of odontoma

1. Trauma during primary dentition
2. Inflammatory and infectious processes
3. Family history
4. Anomalies which are hereditary in nature including Hermann’s and Gardner’s syndrome
5. Hyperactivity of the odontoblast
6. Genetic alterations causing aberrations in signaling pathways controlling tooth development.

Clinicopathological features

Most cases of odontoma are reported within the gnathic bones (intrasosseous), but few rare cases have shown to occur in oral soft tissues (gingiva). Although odontoma is reported mostly in the permanent dentition, few cases have associated with deciduous teeth. The most common location for an odontoma is in the interradicular portion of erupted teeth. Most cases occur in the anterior portion of the gnathic bones, especially in the maxilla. Although relatively less frequent, odontoma has also been reported in the posteroinferior regions.[9] The World Health Organization[4] 2005 classification acknowledges the presence of two odontoma types, the compound and complex odontoma. The former appears as tooth-like structures (denticles) while the latter consists of a disorganized conglomerate of dental tissues (both epithelial and mesenchymal derivatives).

Complex odontomas are relatively rare than compound odontoma with the later accounting for nearly 2/3 of all odontoma cases reported.[10-12] As most odontomas are asymptomatic, their diagnosis is usually a chance finding in a routine panoramic and/or intraoral radiograph. Rarely, cases present with larger lesions causing swelling of the jaw. The presence of an impacted permanent or a retained deciduous tooth is a clinical sign for suspecting odontoma.[9,13] Table 1 summarizes the major clinical and radiological characteristics of the compound and complex

Table 1: Major Clinical and Radiological Characteristics of Odontoma

- Size: Usually small but can exceed the size of a tooth
- Location: Most common in the anterior portion of the gnathic bones, especially in the maxilla
- Symptoms: Usually asymptomatic
- Radiographic findings: Presence of denticles or a conglomerate of dental tissues
- Differential diagnosis: Other odontogenic tumors

Introduction

The term “odontoma” was coined in 1867 by Paul Broca. Odontoma was defined as “tumors formed by the overgrowth of transitory or complete dental tissues.”[1] As odontomas are a result of abnormalities in the proliferation of dental tissues (both epithelial and mesenchymal components), they are not regarded as true neoplasms. In addition, as odontomas do not exhibit continuous growth nor any form of infiltration into the surrounding tissues, they are regarded as hamartomatous malformations. They are often associated with impacted/retained teeth. The extraneous bud of the dental lamina is considered to be the tissue of origin for odontoma.[2,3]
Complex odontoma

Conservative surgical enucleation

Male and female subjects are equally affected

Painless, non-aggressive lesion with a more limited potential growth than the complex odontoma. Often associated with an unerupted permanent tooth

Radio-opaque calcified structures which are small and multiple in numbers. They are anatomically similar to normal teeth. A narrow radiolucent zone usually surrounds the radio-opacity in most cases

Conservative surgical enucleation

Odontoma

Histopathologically, compound odontoma consists of tooth-like structures embedded in a matrix which is loose fibrous in nature. Complex odontoma histopathologically largely shows dentin of the mature tubular form enclosing enamel represented by hollow structures due to decalcification.

Molecular alterations in odontoma formation

Recent studies have delineated multiple molecules aiding in the signaling and transcription of tooth morphogenesis. These include paired box gene 9, msh homeobox 1/2, runt-related transcription factor 2, bone morphogenetic proteins, fibroblast growth factors activin, lymphoid enhancer-binding factor 1 (Lef1), distal-less homeobox 1, Bar H-like homeobox 1, LIM homeodomains, and glioma-associated oncogene homolog (Lef1), distal-less homeobox 1, Bar H-like homeobox 1, LIM homeodomains, and glioma-associated oncogene homolog 1/2/3. These factors are vital for tooth morphogenesis and are spatiotemporally expressed in the tooth germs during development. Odontoma is an analog of a developing tooth germ whose differentiation is incomplete either during the pre-ameloblastic or ameloblastic period, causing aberrant enamel organ mineralization. According to Crivelini et al. dysregulation in tooth morphogenesis and mineralization results in halts, the progression of normal tooth development culminating in the formation of odontoma.

Together with transforming growth factor-β, β-catenins induce morphogenic changes in epithelial cells. β-catenins act as an intracellular signal transducing agent in the Wnt signaling pathway. Wnt signaling, in turn, inhibits degradation of β-catenins. Thus, mutant β-catenin through Shh and Bmp 4 pathway causes increased mesenchymal condensation which leads to excessive ectopic dental hard tissue formation. This could be one of the hypotheses for odontoma formation. The stimulation of the Wnt pathway leads to abundant de novo tooth formation which is the possible etiology for supernumerary teeth and teeth-like structures.

The Wnt-β-catenin-Tcf/Lef activated pathway is closely related to ghost cell formation in odontomas. The cytokeratin (CK) profile of odontoma consists of CK-14 and CK-7 positivity and CK-19 negativity. CK-19 is positive in normal dental tissue and can be used to differentiate from odontomas.

Conclusion

Despite odontoma being one of the most common forms of odontogenic tumors, its molecular biology remains relatively unexplored. Being a relatively non-aggressive odontogenic tumor, it is often not pursued in research. Since odontoma is a proliferating tumor with a close relationship to signaling pathways involved in normal tooth development, exploring its molecular pathogenesis could provide vital information which, in turn, could be exploited in research regenerating dental tissues.

References

6. Singh S, Singh M, Singh I, Khandelwal D. Compound composite odontome associated with an unerupted deciduous incisor-a

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