



Enigma Surrounding Pulpal Cancer - A Re-Exploration

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Abstract

Pulpal Pathologies are the most commonly encountered problem in dental practice. Time and again, emphasis on various sequelae of pulpitis and pulpo-periapical pathologies are detailed in the literature. However, malignancies involving pulpal tissues are seldom spoken about. To explore the presence or absence of malignancy in dental pulp, we did a literature review and arrived at a hypothesis pertaining to the presence or absence of malignancy in pulpal tissue.

While using the search phrase “dental pulp” combined with “sarcoma”, “carcinoma” or “neoplasms” in PubMed when using the MeSH search mode yielded no reports on primary malignant neoplasms. However, a hand search yields clinical reports on pulpal tumours that were published over a century ago. The very existence of primary malignant neoplasms of the dental pulp is questionable when relying on modern information sources. An investigation of this topic should proceed via two specific methods: a review of the published work, and a study of general tumour pathogenesis with respect to specific anatomical prerequisites of the dental pulp.

Patient education and periodic oral cancer examinations by dental professionals are necessary to reduce diagnostic delay and improve prognosis. This review emphasizes the important role of dental professionals, especially periodontists and endodontists, of being aware that squamous cell carcinoma may manifest itself clinically and/or radiographically as a common periodontal or endodontic lesion.

Keywords: Pulpal Tissue; Metastasis; Pulpal Cancer

Introduction

The dental pulp is a unique tissue and its importance in the long-term prognosis of the tooth is often ignored by clinicians [1]. It resides in a rigid chamber comprising dentine, enamel and cementum, which provide strong mechanical support and protection from the microbial rich oral environment [1,2]. It is an unmineralized oral tissue composed of soft connective tissue, vascular, lymphatic and nervous elements that occupies the central pulp cavity of each tooth. In the primary pulp organ, the average length of time a primary pulp functions in the oral cavity is only about 8.3 years. This amount of time can be divided into three periods: Pulp organ growth, pulp maturation and pulp regression [1,2].

Deductive reflections are done on general tumour pathogenesis with respect to specific anatomical prerequisites of the dental pulp. Because of the restricted space in a tooth, tumour expansion will probably lead to the formation of irritation dentine by secondary odontoblasts and, subsequently, to a hemorrhage infarct of the pulp. One hypothesis states that a purported neoplasm of the dental pulp leads to a chronic appositional pulpitis and-sooner or later-will be treated likewise by root-canal treatment or extraction. Further research, including stem-cell studies is recommended [1-5]. Pulpal metastases of various primary tumours have occasionally been reported but primary, malignant, and neoplastic alterations of the dental pulp have seldom been acknowledged in published work.

In the permanent pulp organ, the pulp of the permanent teeth undergoes development for about 12 years, 4 months [1]. The maxillary arches require slightly longer to complete each process of development than do the mandibular arches [1].

Some of the pathologies in pulp of the teeth are [10]: Fibrosis, False attached Denticles, True Denticles with tubules, False free Denticles, Embedded Denticles, Pulp stones/Pulpal calcifications/ Diffused calcifications, Regressive Changes and Cancer of pulp????

History regarding Pulpal Cancer

There were some interesting cases published previously where, Malignant neoplasms in dental pulps were first reported in the late 19th and early 20th centuries as incidental findings in autopsies [2]. In 1904 Latham provided the first true histological evidence of an intrapulpal neoplasm describing an epithelioma of the dental pulp [2,7]. Further mentions of intrapulpal neoplasms have been made by Rebel (lymphoma) and Euler (neuroma) [8,9]. Euler also stated that genuine neoplasms of the dental pulp are quite rare. In 1937, Thuringer presented a case of a mixed teratoma-like tumour of the dental pulp [10]. In 1909, the German pathologist Schmorl first reported pulpal metastasis of a primary breast cancer. In 1934, Zajewloschin and Libin presented a case series of 56 patients with neoplasms of the jaws and found involvement of the dental pulp in 17 patients [13]. Malignant tumours affecting the dental pulp are predominantly found in fully emerged teeth of mature patients (in their fifth to sixth decade of life) [2,14]. Since 1947, several case reports have described intrapulpal metastases of extraodontal tumours [15,16]. However, the locations of affected teeth and clinical symptoms, such as toothache or vitality of the dental pulp, have not been clearly described. Some related recordings regarding pulpal cancer till date:

1. Metastatic infiltration of the dental pulp by medulloblastoma [6].
2. Squamous Cell Carcinoma presenting as an Endodontic - Periodontic Lesion [11,12,19].
3. Metastatic Carcinoma of the mandible that mimicked pulpal/periodontal disease [5].
4. Perineural fibrous thickening within the dental pulp in type 1 neurofibromatosis [3].

Table for different articles with regard to occurrence of pulpal cancer

Sl. No	Title	Author/ Researcher	Year of Publication
1	Teeth: malignant neoplasms in the dental pulp	Newhaus KW	2007
2	Perivascular niche of postnatal mesenchymal stem cells in human bone marrow and dental pulp	Shi S, Gronthos S.	2003
3	Metastatic infiltration of the dental pulp by medulloblastoma	Ahmed S., et al.	2002
4	Bone-like tissue growth in the root canal of immature permanent teeth after traumatic injuries	Heling I, Slutzky-Goldberg I, Lustmann J, et al.	2002
5	Squamous Cell Carcinoma presenting as an Endodontic - Periodontic Lesion	Mjor IA.	2002
6	Postnatal human dental pulp stem cells (DPSCs) <i>in vitro</i> and <i>in vivo</i> .	Gronthos S, Mankani M, Brahim J., et al.	2000
7	Metastatic Carcinoma to the mandible that mimicked pulpal/periodontal disease	Seldon SH, Manhoff TD, Hatges AN, Michel CR	1998
8	Perineural fibrous thickening within the dental pulp in type 1 neurofibromatosis	Curtin PJ	1997
9	Dental pulp metastases and pan-osseous mandibular involvement with mammary adenocarcinoma	Shankar S	1984
10	Dysplasia of the dental pulp: follow-up of a case report.	Diner H, Chou MD	1978
11	Jaw and pulpal metastasis of an adrenal neuroblastoma.	Snyder MB, Cawson RA.	1975
12	Metastasising neuroectodermal tumours of the central nervous system	Smith DR, Hardman JM, Earle KM	1969
13	Pulpal metastases from Ewing's sarcoma. Report of a case.	Hunter HA, Poyton HG	1963

14	Intracranial tumours with extracranial metastases.	Glausauer FE, Yuan RHP	1963
15	Involvement of the dental pulp by malignant tumors of the oral cavity.	Stewart EE, Stafne EC	1955
16	Metastasis of chondromyxosarcoma to the jaw and tooth.	Robinson HBG	1947
17	Incipient dental tumor involving pulp and parodontium	Thuringer JM	1937
18	Histological examination of teeth in neoplasms of the jaw.	Zajewloschin MN, Libin SI	1934
19	Intrapulpal neoplasm describing an epithelioma of the dental pulp	Latham	1904

Discussion

Accumulated evidence indicates that cytotoxic function of immune effectors is largely suppressed in the tumor microenvironment by a number of distinct effectors and their secreted factors [19]. Natural Killer (NK) cells mediate significant cytotoxicity against primary oral squamous carcinoma stem cells (OSCSCs) as compared to their more differentiated oral squamous carcinoma cells (OSCCs) [20,21].

In addition, human embryonic stem cells (hESCs), Mesenchymal Stem Cells (hMSCs), dental pulp stem cells (hDPSCs) and induced pluripotent stem cells (hiPSCs) are all significantly more susceptible to NK cell mediated cytotoxicity than their differentiated counterparts or parental cells from which they were derived [20,21]. Inflammations of the dental pulp as a result of neoplastic alterations are generally considered nonexistent.

While using the search phrase “dental pulp” combined with “sarcoma”, “carcinoma”, or “neoplasms” in PubMed when using the MeSH search mode yielded no reports on primary malignant neoplasms. However, a hand search yields clinical reports on pulpal tumours that were published over a century ago. Deductive reflections are done on general tumour pathogenesis with respect to specific anatomical prerequisites of the dental pulp [11,12].

Because of the restricted space in a tooth, tumour expansion will probably lead to the formation of irritation dentine by secondary odontoblasts and, subsequently, to a hemorrhage infarct of the pulp [13,18]. One hypothesis states that a purported neoplasm of the dental pulp leads to a chronic appositional pulpitis and-sooner or later-will be treated likewise by root-canal treatment or extraction [18,19].

Further research, including stem-cell studies, is recommended. Pulpal metastases of various primary tumours have occasionally been reported but primary, malignant, and neoplastic alterations of the dental pulp have seldom been acknowledged in published work. Indeed, the very existence of primary malignant neoplasms of the dental pulp is questionable when relying on modern information sources.

An investigation of this topic should proceed via two specific methods: a review of the published work, and a study of general tumour pathogenesis with respect to specific anatomical prerequisites of the dental pulp.

Pulpal Cancer- is it a possibility?

There is no reason why cells of the dental pulp, such as fibroblasts, pericytes, stem cells and epithelial cell rests of Malassez, should not act in the same way, as all these cells have mitotic competence, which can be shown by the disease pattern of pulp polyps. Because of the anatomically restricted space of the dental pulp, any clonal growth of the tumour would be limited and further associated with necrosis. And tumour expansion would increase the intrapulpal pressure, as would the resulting formation of hard tissue, which can even result in the strangulation of pulpal tissue.

Additionally, the more apical the tumour growth, the higher the risk of a haemorrhagic infarct of the pulp, thus limiting its growth by itself. Because sarcoma has the capacity to exist in the dental pulp, predictions can be made about the tumours potential to metastasize. Chandler and colleagues’ states that the necessary cell mass for haematogenic metastasis of individual clonal cells is 106 cells, which equates to a spatial volume of about 1 cm³. Such a volume is not usually provided by the endodontic macroenvironment [4,22,23].

Conclusion

Pulpal cancer is a very rare entity. Patient education and periodic oral cancer examinations by dental professionals are necessary to reduce diagnostic delay and improve prognosis. This review emphasizes the important role of dental professionals, especially periodontists and endodontists, of being aware that squamous cell carcinoma may manifest itself clinically and/or radiographically as a common periodontal or endodontic lesion.

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