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CLINICAL SYMPTOMATOLOGY, DIAGNOSIS, MORPHOLOGICAL STRUCTURE, AND MANAGEMENT OF CEMENTOMAS

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Clinicians classify cementoma – a tumor of mesenchymal origin tightly associated with tooth roots – as a variant of odontomas. Conversely, pathomorphologists consider cementomas to be lesions of both neoplastic and dysembryogenetic nature, the common feature of which is the presence of cementum-like tissue in the apical region. We analyzed a clinical case of a mandibular cementoma in the region of tooth 36, detected radiographically in a patient referred by an orthodontist for a consultation regarding the extraction of the follicles of other teeth. The clinical scenario and the definitive diagnosis, given certain discrepancies in the nosological classification of cementomas, prompted us to analyze the literature and summarize our own clinical observations regarding this pathology. The obtained results allowed for the determination of the clinical, diagnostic, and morphological features of specific types of cementomas listed in the WHO International Histological Classification of Tumors, as well as their management strategies. The features distinguishing cementomas from clinically similar pathological processes are presented. Particular attention is paid to condensing osteitis, a variant of chronic apical periodontitis that develops in response to prolonged inflammation.

Key words: cementoma, odontoma, hypercementosis, osteosclerosis, condensing osteitis.

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КЛІНІЧНА СИМПТОМАТИКА, ДІАГНОСТИКА, МОРФОЛОГІЧНА СТРУКТУРА ТА ЛІКУВАННЯ ЦЕМЕНТОМ

До різновидів одонтом клініцисти відносять цементому – пухлину мезенхімального походження, інтимно пов'язану із коренями зубів. Натомість патоморфологи вважають цементоми ураженнями як пухлинної, так і дизембріогенетичної природи, загальною ознакою яких є наявність цементоподібної тканини в апікальній ділянці. Нами проаналізовано клінічний випадок цементоми нижньої щелепи в ділянці 36 зуба, виявленої рентгенологічним дослідженням у пацієнта, направленого ортодонтом на консультацію з приводу видалення фолікулів інших зубів. Клінічна ситуація та остаточний діагноз із урахуванням деяких розбіжностей у визначенні нозологічної приналежності цементом спонукали нас до аналізу літературних даних із узагальненням власних клінічних спостережень щодо зазначеної патології. Отримані результати дозволили визначити клінічні, діагностичні і морфологічні особливості окремих видів цементом, наведених у Міжнародній гістологічній класифікації пухлин ВООЗ, та лікувальну тактику. Представлено ознаки, що відрізняють цементоми від клінічно схожих патологічних процесів. Окрема увага приділена конденсованому оститу як варіанту хронічного апікального періодонтиту у відповідь на тривале запалення.

Ключові слова: цементома, одонтома, гіперцементоз, остеосклероз, конденсований остит.

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Odontomas are relatively common entities encountered by oral and maxillofacial surgeons, including pediatric specialists, in the course of providing specialized medical care. Their diagnosis, the choice of treatment strategies and surgical techniques, and the prevention of recurrences and potential complications can sometimes present significant challenges and professional dilemmas, even for experienced specialists [2, 12].

The majority of the contemporary medical community recognizes that odontomas are classified as hard or soft, depending on the types

and quantities of their structural components. In turn, clinicians consider cementoma (CT) a variant of hard odontomas – tumors of mesenchymal origin intimately associated with the root of one or several teeth, which subsequently increases the likelihood of root damage during tooth extraction [1, 6, 10].

However, most pathomorphologists hold a different view, considering cementomas to be lesions of both neoplastic and dysembryogenetic nature, the common feature of which is the presence of cementum-like tissue with varying degrees of mineralization in the root region. Conversely, they define odontomas as tumor-like processes resulting from a disruption of odontogenesis and thus representing hamartomas [9].

According to statistical data, the prevalence of CT within the structure of maxillofacial tumors ranges from 0.8 % to 3.7 %. Researchers note that among adult patients, these lesions are more frequently identified in females and predominantly localized in the body and angle of the mandible, most commonly associated with premolars and molars. Conversely, in children, CT is more commonly observed in the maxilla and often shows no connection to tooth roots. The locally destructive growth pattern of certain cementomas, combined with their capacity for unrestricted expansion, accounts for their potential invasion of the paranasal sinuses and the skull base [1, 2, 13].

Despite a number of distinct clinical and morphological features characterizing CT, the primary elements of their diagnosis in daily dental practice remain the clinician's experience and the ability to perform a comprehensive evaluation of the scarce symptoms that accompany the course of the disease, combined with the interpretation of radiological findings. The low incidence of this nosology, which typically localizes to the periapical region of the jaws, clearly explains why this factor is primarily associated with difficulties in the differential diagnosis of cementomas, or even with outright diagnostic errors leading to an incorrect choice of treatment strategy.

The purpose of the study was to draw the attention of the dental community to the necessity of an in-depth scientific and clinical investigation of cementomas by presenting a clinical case and conducting a comparative analysis of the available literature data.

Materials and methods. A 16-year-old male patient (Patient K.) was referred to the Clinic of the Department of Pediatric Oral and Maxillofacial Surgery at Poltava State Medical University by an orthodontist for a consultation regarding the extraction of the follicles of teeth 18, 28, 38, and 48, aimed at creating favorable conditions for orthodontic bite correction.

Upon examination, complaints characteristic of odontopathology were absent. Inspection of the dentition revealed that all teeth in both the maxillary and mandibular arches were intact.

To determine the topography of the mentioned tooth follicles for subsequent planning of the optimal surgical approach, a radiological examination (orthopantomography) was performed. In addition to resolving the aforementioned tasks, the results revealed a non-homogeneous, rounded lesion up to 10 mm in diameter with distinct, irregular borders in the bone tissue of the mandible, specifically in the root region of tooth 36. Against the background of radiopaque zones of similar density to compact bone, structureless shadows were also identified (Fig. 1).

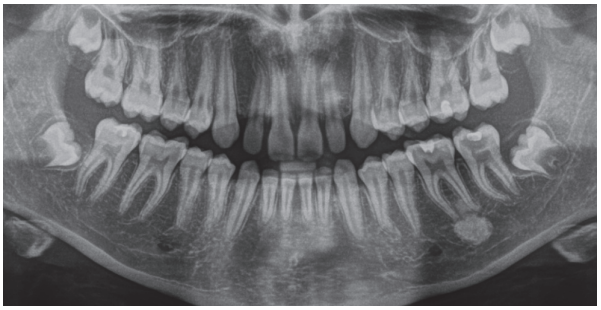

Fig. 1. Orthopantomogram of a 16-year-old male patient (Patient K.); description provided in the text.

The obtained radiological presentation prompted a more thorough clinical examination of the specified dentoalveolar segment. However, even after this, against the background of an asymptomatic state, no visible alterations in facial symmetry were detected. The skin over the projected area maintained its natural color, regional lymph nodes were non-palpable, and mouth opening was unrestricted.

Percussion of the intact tooth 36 was painless, and no pathological changes were observed in the gingiva or the transitional fold of the corresponding mandibular region. Tactile and pain sensitivities on the respective side of the mandible and adjacent soft tissues were fully preserved, and no disruption of the mandibular contours was noted upon palpation.

Based on a summary of the anamnesis, the asymptomatic state, the objective examination findings, and the radiological presentation, and considering the patient's adolescent age, a clinical diagnosis was established: cementoma of the mandible in the region of tooth 36.

Following the establishment of the clinical diagnosis, the follicles of teeth 18, 28, 38, and 48 were extracted, and Patient K. was referred for orthodontic treatment, whereas a strategy of dynamic observation was selected regarding the aforementioned lesion.

Results of the study. Distinct aspects of the presented clinical case are highlighted in chronological order. Specifically, the pathology was observed in the mandible of a young patient, exhibited an asymptomatic nature, and required differential diagnosis from other similar nosological

entities, particularly condensing osteitis, information on which we encountered exclusively in available foreign literature sources.

We selected a strategy of dynamic observation of the course of the pathology, with the understanding that, in the event of progression, surgical treatment will be undertaken. This would involve conservative curettage down to the sclerosed bone, utilizing various options for the subsequent management of the postoperative bone wound without tooth extraction, though it would require endodontic treatment and potentially a root-end resection.

The described clinical situation and the established clinical diagnosis in a young patient, along with certain discrepancies in the nosological classification of cementomas among clinicians and pathomorphologists, prompted us to analyze the literature and summarize our own clinical observations on these issues.

If CT is considered not as a true neoplasm but as a tumor-like process, its morphogenesis can be outlined as follows: the proliferation of fibroblasts and collagen fibers in the apical region of the periodontium leads to the resorption of the surrounding structural components of the bone tissue, followed by the differentiation of cementoblasts accompanied by intense mineralization, culminating in the ossification of the fibrous tissue. Consequently, such a lesion presents as a calcified mass surrounded by a narrow radiolucent rim.

The exact causes of CT development remain undetermined; however, researchers describe a number of precipitating factors associated with their onset, which include trauma (jaw contusions, fractured restorations, defective dental prostheses, etc.), the presence of foreign bodies in root canals (posts, fragments of broken endodontic instruments, etc.), and chronic inflammation (periodontitis, osteomyelitis, etc.).

In the vast majority of cases, cementomas are asymptomatic when an adjacent vital tooth is present and are diagnosed radiologically (Fig. 2), with subsequent pathomorphological verification of the surgical specimen.

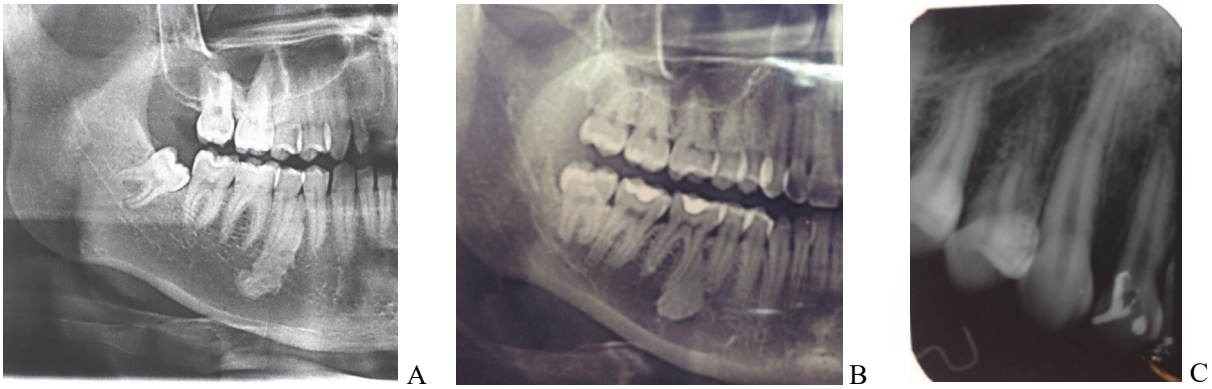

Fig. 2. Radiological presentation of cementomas in the region of teeth 45 (a), 46 (b), and 13 (c); photographs from the authors' personal archive.

The differential diagnosis of cementoma is of particular interest because the literature describes several pathological conditions that also involve tissue densification in the periapical region, most notably hypercementosis and osteosclerosis.

It is noted that hypercementosis (Fig. 3) is an excessive deposition of cementum on the surface of the tooth root, which, in most cases, assumes a club-shaped appearance, fully involving the root. Concurrently, radiological findings demonstrate that the adjacent bone tissue mostly retains its normal structure.

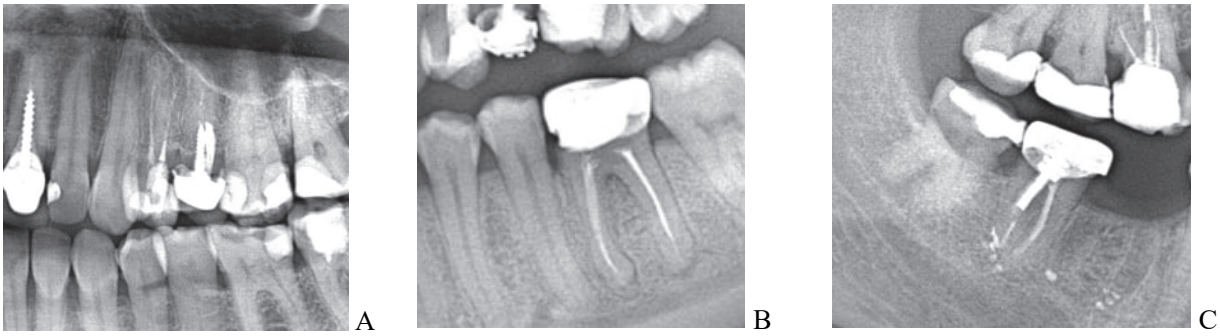

Fig. 3. Fragments of orthopantomograms of patients with hypercementosis of teeth 24 (a), 36 (b), and 48 (v); photographs from the authors' personal archive.

It is considered that the deposition of secondary cementum represents a compensatory response, occurring in chronic periodontitis, during tooth extrusion during dental operations, or as a result of occlusal trauma.

Hypercementosis can manifest locally, diffusely, or in a generalized manner. Its local form is associated with the presence of free or interstitial cementicles up to 0.5 mm in diameter on the outer

root surface and within the periodontal ligament. The formation of these cementicles is linked to the ectopic (outside the cementum) activity of cementoblasts, which can be initiated by remnants of the odontogenic epithelium within the periodontal ligament (rests of Malassez). Under these conditions, nodules and spikes form on the lateral and interradicular surfaces of the teeth at the sites of cementicle development.

Conversely, diffuse hypercementosis, characterized by excessive cementum deposition across the entire root surface, is typically associated with chronic inflammatory periodontal lesions. In advanced stages of the disease, excessive cementum production can lead to ankylosis between the tooth root and the alveolar bone wall.

In the generalized form of hypercementosis – mostly associated with hormonal disorders involving active bone destruction and intense cementum formation necessary for repair and tooth fixation within the alveolus – excessive cementum deposition occurs across all teeth.

It should be noted that no form of hypercementosis per se affects tooth vitality. The "causative" tooth also remains vital in osteosclerosis, which is usually not a consequence of infectious agents. The density of the newly formed bone tissue significantly exceeds that of the surrounding bone, with which the area of bone formation merges without visible borders.

Discussion. According to the literature, most researchers note that cementomas occur predominantly in the mandible of individuals aged 15–30 years [11, 14]. According to the WHO International Histological Classification of Tumours, they are classified into [1, 2, 6]: benign cementoblastoma (true cementoma); cementifying fibroma; periapical cemental dysplasia (periapical fibrous dysplasia); and gigantiform cementoma (familial and multiple cementoma).Each of these types of CT has distinct characteristics.

Specifically, cementoblastoma (true cementoma) is a benign neoplasm tightly associated with the affected tooth, capable of causing root resorption and radiologically presenting as a well-demarcated calcified mass.

Macroscopically, it presents as a dense-elastic lesion with moderate calcification or fragments of poorly mineralized bone. Microscopically, it is characterized by mesh-like, interwoven sheets of mineralized material lacking trabecular bone.

Some researchers emphasize that, at the microscopic level, this variant of CT closely resembles cellular or acellular dental cementum, with the presence of cementoblasts and cementoclasts, thereby providing clinicians with a rationale for classifying true cementomas as essentially simple odontomas.

Typically, such a tumor possesses a capsule that demarcates it from the healthy bone.

Conversely, cementifying fibroma consists of fibrous tissue interspersed with round, intensely stained basophilic masses of cementum-like tissue (cementicles). It is also surrounded by a capsule.

Periapical cemental dysplasia, which is predominantly identified in females of African descent aged 30–50 years, is localized primarily in the apical region of the mandibular incisors. Its onset is linked to a disruption in cementogenesis. Structurally, this variant of CT resembles fibrous dysplasia, progressing through osteolytic, calcifying, and mature stages.

Gigantiform cementoma is a genetically determined form of dysplasia or developmental anomaly characterized by connective tissue transformation accompanied by the formation of an acellular cementum-like substance with areas of intense calcification. It merges tightly with the tooth root, leading to the complete obliteration of the periodontal ligament space. Occurring quite rarely, this tumor can exhibit a hereditary pattern, with multiple lesion sites identified across several family members.

Thus, all researchers concur that only the first two forms of cementomas are truly neoplastic [7].

Concurrently, the radiographic presentation varies depending on the type of lesion and its stage of development. For instance, it may present with a "plus-tissue" sign – a regularly shaped, rounded area with a density similar to that of tooth tissues, tightly associated with its root portion. The periodontal ligament space around the root is absent, and a thin, radiolucent band corresponding to the zone of bone rarefaction is observed along the periphery. Conversely, a "minus-tissue" sign may also be detected, where zones of hypermineralization are identified against the background of bone tissue rarefaction [3, 4, 8].

One must also not overlook observations reported by other authors in which the presence of CT is accompanied by jaw deformity, typically without changes in the color of the mucous membrane. Furthermore, in cases where the tumor perforates the cortical bone layer, sensitivity or pain arises in the affected area, manifesting not only during palpation but also during mastication and speech. Mucosal damage may even occur, with subsequent secondary infection or ulceration [5, 9, 12].

Some researchers classify condensing osteitis as a variant of osteosclerosis, considering it a form of chronic apical periodontitis that develops in response to a prolonged inflammatory process; it is also referred to by some as a denticle [8].

It is noted that this pathology occurs predominantly in 4–8 % of adults, most frequently in the periapical region of the mandibular premolars and molars; however, similar cases have also been described in patients in their twenties.

Condensing osteitis is believed to develop primarily in individuals with a high degree of

systemic resistance, due to increased osteoblast activity stimulated by low-virulence infectious agents. In general terms, this process can be described as follows: inflammation of the pulp leads to its necrotic changes, and the degradation products spread through the root canal system, causing reactive inflammation of the periapical tissues, the course of which depends on the pathogenic properties of the pathogen and the individual resistance of the host [4].

Visually, a tooth significantly destroyed by a carious process may not cause any discomfort or, conversely, may present with a variety of symptoms characteristic of both pulp and periapical tissue inflammation, responding to thermal or electrical stimuli.

Radiographically, the pathological lesion is radiolucent with either well-defined or ill-defined borders, located within the apical region of the root and occasionally extending a few millimeters beyond its apex. In terms of radiopacity, it differs from root cementum; thus, the periodontal ligament, the volume of which is slightly increased, is always clearly distinguishable [5].

Histologically, a large number of randomly arranged, dense bony trabeculae, interspersed with lymphocytes and plasma cells, are present in the root apex region. Depending on the degree of calcification, such an area may present as compact bone or fibrous tissue with an abundance of inflammatory cells. Furthermore, oval, linear, and curved trabeculae, surrounded by active osteoblasts, are also present there [15].

Overall, the management strategy for CT remains largely uncontroversial and is not a subject of debate within dental circles. Researchers unanimously agree that if the lesion is asymptomatic, shows no signs of acute or chronic inflammation, and the patient does not insist on it, surgical intervention can be withheld.

Periapical cemental dysplasias and gigantiform cementomas also do not require surgical treatment, a point emphasized by some researchers [15]; however, it is not entirely clear to us how they can differentiate these forms in clinical practice without direct pathomorphological examination of the surgical specimen.

Conversely, a portion of researchers emphasize the expediency of tooth extraction coupled with cementoma removal [8].

While we do not have our own clinical observations on the treatment of condensing osteitis, researchers suggest that it should be managed endodontically and conservatively, without deviating from the therapy for other types of pulp and periodontal pathologies. The authors note that a successful treatment outcome, achieved in 70 % of cases, is characterized by the resolution of the sclerotic zone and the restoration of the normal volume of the periodontal ligament. Meanwhile, the 30 % failure rate is attributed to individual variations in the course of the pathology [5].

Conclusions

1. Cementoma is a nosological entity characterized by an asymptomatic course that can cause certain diagnostic difficulties, consequently potentially leading to undesirable outcomes and complications.

2. In-depth morphological evaluation of cementomas can assist clinicians and pathomorphologists in reaching a consensus regarding the specific classification of this pathology.

3. The presence of pathological conditions involving periapical tissue densification, including condensing osteitis, which is of particular interest, necessitates a more detailed investigation of the differential diagnosis of cementomas.

Prospects for future research. In the future, we plan to focus on determining the immunohistochemical and morphological features of cementomas in patients of various age groups.

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