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Chair and Department of Paedodontics Medical University of Lublin

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Hard dental tissues mineralization disorders – case study

Zaburzenia mineralizacji twardych tkanek zębów – opis przypadku

Calcium-phosphorus homeostasis allows for the maintenance of systemic mineral balance and, consequently, bone metabolism. The main hormones regulating this process are parathormone and calcitonin. Vitamin D is another important element.

Vitamin D deficiency causes changes in bone tissue including hard dental tissue. One of the key processes of teeth development is the process of mineralization. This process involves ameloblasts, odontoblasts, cementoblasts, hypertrophic chondrocytes of the epiphyseal cartilage, as well as osteoblasts of most hard dental tissues facilitating the development of enamel, dentine and cement [quoted after 3]. Two stages can be distinguished in the process of teeth mineralization. The first one involves the creation of extracellular matrix and the second is the actual mineralization process. In the second stage we can distinguish the secretion of matrix vesicles and heterogenic nucleation. The main compounds absorbed by the organic matrix are calcium phosphates. The organic matrix consists mainly of type 1 collagen, phosphoproteins, phospholipids and proteoglycans. Enamel hypoplasia is a quantitative disorder, thus, it is characterized by enamel thickness reduction. It can occur on the form of pits and fissures, incisal margins folding as well as partial or total enamel deficiency. It should be stressed that some authors additionally distinguish mottled hypoplasia (white or dark brown spots). Others claim that hypoplasia can only be diagnosed when we observe enamel surface layer breakage [1, 4, 5].

Deficiency of vitamin D, which is necessary for correct bone and hard dental tissues mineralization, may be the result of insufficient amount of dietary vitamin D, vitamin D absorption disorder or resistance to active form of vitamin D. The typical result of vitamin D deficiency is rickets, growing bone mineralization disorder. Clinical and radiological symptoms of the disorder are the occurrence of widened epiphyseal cartilage, overgrowth of cartilage at the costochondral junction and thickening of long bones extremities. Patients diagnosed with vitamin D deficiency present muscle weakness, slower growth, delayed teeth eruption and visible frontal tubers. Recently, in order to evaluate the developmental enamel disorders, the Development Defects of Enamel Modified Index (DDE – Modified Index) is used. The index includes 10 codes characteristic for the respective developmental disorders. In case of this index, code 0 means lack of any pathological changes. Codes 1-2 mean that there is enamel opacity of various intensity and range.

Code 3 means the presence of hypoplasia. Code 4 characterizes other enamel defects, code 5 depicts enamel opacity, codes 6 to 8 mean coexistence of enamel opacity and hypoplasia (the level depends on the degree of lesions), and code 9 describes other developmental enamel defects. In case of this index the buccal dental surfaces of teeth 14-24 as well as 36 and 46 are examined [2, 4].

CASE REPORT.

A female patient aged 12 years and 1.5 months attended the Chair and Department of Paedodontics Medical University of Lublin. The patient's mother reported that there were complications during her pregnancy. There occurred hyperemesis gravidarum and threatened preterm labor, uterine cramping and bleeding. In course of the pregnancy, antispasmodic, antihemorrhagic and hormonal medicines were applied (no data concerning the actual drugs used). Labor took place in the 37th week of gestation. It was complicated by hypoxia and intrauterine hypoglycemia. It was a vaginal labor and lasted 30 hours. Umbilical cord torsion was present. The birth weight was 3150 g. The newborn received 9 points in the APGAR scale. On the basis of the presented medical documentation, it was found that lateral nystagmus occurred in the 3rd month of the patient's life. The performed EEG examination revealed intensified delta activity in the occipital lobe and lack of features of obvious seizure activity in EEG records and child's behavior. Clinical examination performed later showed the presence of symptoms characteristic for rickets (hypotonia, rachitic rosary, Harrison's groove). Genetic examination did not reveal any genetic disorders. In 2007, during hospitalization in Pediatric Clinical Hospital, on the basis of radiological examination, the patient was diagnosed with single left-sided scoliosis without vertebral rotation as well as shortened left lower limb and lowered left posterior iliac spine. The patients also suffered from neurogenic muscle weakness. The mother reported that the child remains under constant neurological, orthopedic and ophthalmological care (the patients has a high degree of myopia). At the same time the patient suffered from frequent higher and lower airways infections, vaginal and urinary bladder inflammation usually treated with antibiotics. The performed examinations revealed the presence of food allergy (to egg white, chicken meat, pork, rye flour (insufficient diet), pollen grains and animal fur – the patient takes Zyrtec on regular basis and sometimes Pumicort.

EXTRAORAL EXAMINATION DID NOT REVEAL ANY CHANGES.

Intraoral examination showed the occurrence of white and dark brown spots, pits and fissures of the enamel surface as well as changes in teeth shape. Using the Development of Enamel Modified Index, the observed lesions were classified with code 9 (image 1, 2). Generalized chronic inflammatory state of marginal parodontium was also observed (the mother declared that this state had been present for about 2 years). The patient's teeth were cleaned, the plaque was removed and supragingival and subgingival scaling was performed. Metronidazole lotion was also applied to the lesions. Oral hygiene care instructions were given to the patients. The patient was also advised to take good care of oral cavity hygiene and use rinses containing chlorhexidine facilitating chemical control of dental plaque formation. The probable reason for the parodontosis was improper oral hygiene status, which in turn resulted from difficulties with correct tooth brushing due to incorrect teeth structure. However, taking patient's history

and the oral hygiene status into account, especially the long-term inflammatory state of the marginal gingival, additional examinations were ordered (blood cell count with manual blood smear, CRP, the level of glucose, urea, uric acid creatinine, and bilirubin as well as liver tests). The test results were within referential values. On the basis of clinical examination results the patient was referred to radiological laboratory for pantomography (image 3).

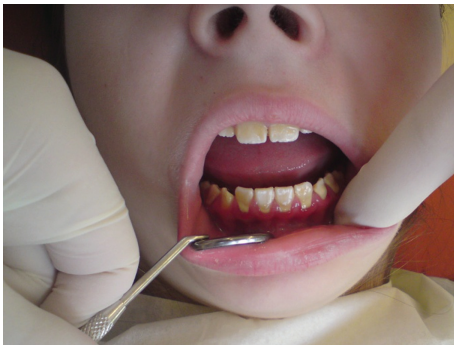

Image 1. Developmental disturbances of front teeth

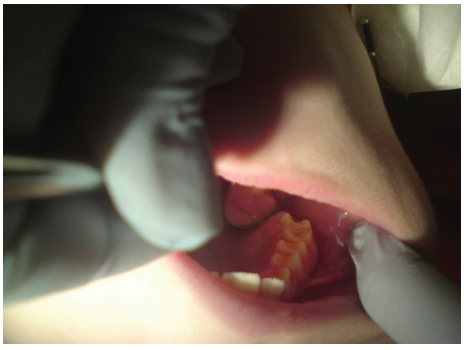

Image 2. Developmental disturbances of posterior teeth

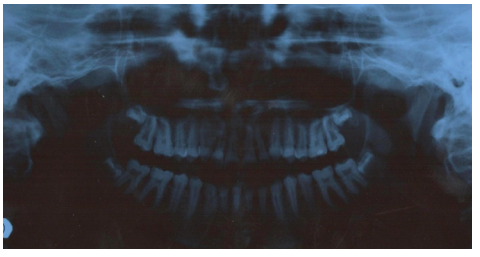

Image 3. Panthomogram

In course of a follow-up visit it was found that the state of marginal parodontium was significantly improved. The results of the performed laboratory tests were within referential values. The pantomograph revealed disorders in the hard dental tissues structure and correct root structure. The treatment applied involved professional exogenous fluoride prophylaxis - teeth varnishing with

Fluoride Protector. Follow-up visits every 1-2 months were advised. The planned treatment is the application of varnishes including fluoride compounds and, after the completion of developmental period, prosthetic treatment. The patient remains under the care of the Chair and Department of Paedodontics Medical University of Lublin.

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SUMMARY

Vitamin D deficiency causes changes in bone tissue including hard dental tissue. Deficiency of vitamin D, which is necessary for correct bone and hard dental tissues mineralization, may be the result of insufficient amount of dietary vitamin D, vitamin D absorption disorder or resistance to active form of vitamin D. A female patient aged 12 years and 1.5 months attended the Chair and Department of Paedodontics Medical University of Lublin. Intraoral examination showed the occurrence of white and dark brown spots, pits and fissures of the enamel surface as well as changes in teeth shape. The planned treatment is the application of varnishes including fluoride compounds and, after the completion of developmental period, prosthetic treatment.

Keywords: tooth mineralization, tooth developmental disturbances, vitamin D deficiency

STRESZCZENIE

Niedobór witaminy D powoduje zmiany w tkankach kostnych, ale także w twardych tkankach zębów. Niedobór witaminy D, niezbędnej dla prawidłowej mineralizacji kości oraz twardych tkanek zębów może wynikać z braku dostarczania tej witaminy wraz z dietą, zaburzeniami wchłaniania oraz opornością na aktywną postać witaminy D. Do Katedry i Zakładu Stomatologii Wieku Rozwojowego zgłosiła się pacjentka w wieku 12 lat i 1,5 miesiąca. Badaniem wewnątrzustnym stwierdzono występowanie białych i brunatnych plam, rowków, załamań powierzchownej warstwy szkliwa, i zmian kształtu zębów. Planowane leczenie to stosowanie lakierów zawierających związki fluoru oraz po zakończeniu okresu wzrostu leczenie protetyczne.

Słowa kluczowe: mineralizacja zębów, zaburzenia rozwojowe zębów, niedobór witaminy D.