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Dental developmental defects in a subadult from 16th–19th centuries Bucharest, Romania

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ABSTRACT

This study examines the dental developmental defects seen in an individual recovered from the Saint Sava cemetery from Bucharest, Romania, dated to the late medieval/early modern period. The remains display extended hypoplastic alterations of the permanent dentition, including linear, pitted, and planar defects. The first permanent molars are distinctive, with multiple indentations and mottling. Given the unusual pattern of defects and the close resemblance to a series of archaeological cases recently published and assigned to congenital syphilis, a differential diagnosis is discussed, with particular reference to the effects induced not only by treponemal infection, but also by treatment with mercury and nutritional deficiency.

1. Introduction

Dental enamel defects occur as a consequence of disruptions affecting ameloblasts during matrix formation and produce defects visible on the surface of the tooth crown. These alterations can be a result of local trauma, hereditary conditions, or systemic metabolic disruption in the form of malnutrition, fever, or disease (Hillson and Bond, 1997). Systemic disturbances potentially lead to defects that are discernible throughout the dentition in areas of enamel forming at the same time, though variation can be expected (Hassett, 2014). Dental enamel hypoplasia is often used as a nonspecific indicator of physiological stress during early life (Goodman and Armelagos, 1985).

Hypoplastic defects are manifested in various forms, including furrows, pits, or areas of missing enamel. However, the lesions visible at a macroscopic level are ultimately caused by alterations to enamel microstructure. Dental enamel is laid down by ameloblast cells in successive layers from cusp tip to root apex (Hillson and Bond, 1997; Hassett, 2014). By means of microscopic observation, it has been demonstrated that tooth development is a nonlinear process, with enamel formation taking place during variable intervals after initial mineralization (Reid and Dean, 2000). The overlapping layers of enamel visible on the crown surface conceal a great amount of enamel deposited in the first stages of development, with up to one half crown formation hidden in molars beneath the cusps (Hillson and Bond, 1997). The size of a defect is influenced by both its location and duration of growth disruption, which is important for timing the defects in order to better understand their etiology (Hassett, 2014).

In bioarchaeological research, several recent studies describe dental developmental defects attributed to congenital syphilis (Gaul and Grossschmidt, 2014; Gaul et al., 2015; Ioannou et al., 2016), which could potentially occur as the result of other stressors (Ogden et al., 2007, 2008). Congenital syphilis is but one of the conditions that leaves characteristic lesions on the dentition. This disease is caused by transmission of *Treponema pallidum* to the fetus in the first or secondary stage of maternal infection with venereal syphilis. The condition can lead to spontaneous abortion, stillborn or prematurely born babies, or death soon after birth (Harper et al., 2011; Hillson et al., 1998). In surviving children the infection can develop between birth and 1 or 2 years of age (early stage) or later, from 2 years after birth to adolescence (late stage). A series of skeletal lesions are characteristic for each of these stages, while the dentition also shows specific abnormalities that develop in the early years but become evident after the eruption of the affected teeth, usually the permanent incisors and the first permanent molars (Hillson et al., 1998). Hutchinson's incisors, Fournier

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molars, and Moon's or bud molars are deformities occurring in the permanent dentition and presenting distinct attributes that were documented in patients from the pre-antibiotic era (Hutchinson, 1861; Ioannou et al., 2016). The incidence of these defects in clinical patients varies from 10 to 65%, with individual variation in the morphology of dental alterations (Ioannou et al., 2016; Hillson et al., 1998). Although the value of these defects as diagnostic tools is higher than that of skeletal lesions, similarities in dental pathological features makes differential diagnosis a challenge (Hillson et al., 1998). In a recent paper, Ioannou et al. (2016) highlighted the difficulty of discriminating between the changes caused by treponemal infection and those caused by treatment with mercury.

Here, we present the case of a subadult individual retrieved from burial PU517b from the 16th–19th century necropolis of Saint Sava from Bucharest, Romania, who shows a series of developmental defects in the permanent dentition. Following the description of dental malformations, this individual is compared to previous studies and diagnostic options are discussed, particularly with regard to congenital syphilis and the effects of medicinal treatment with mercury.

2. Materials and methods

Individual PU517b was recovered from the late medieval/early modern cemetery surrounding the church of Saint Sava, located in Bucharest, Romania. The church and its adjacent cemetery functioned from the early 16th century until the first half of the 19th century. This chronological timeframe was determined based on funerary inventory (Velter and Mănucu-Adameşteanu, 2013) and radiocarbon dating undertaken at the Poznan Radiocarbon Laboratory. Following salvage excavations conducted between 2010 and 2011, 676 graves and 624 individuals were recovered from the necropolis. The skeletal sample included 133 subadults. During morphological examination, all were screened with regard to pathological changes on skeletal and dental elements, leading to the identification of venereal syphilis and tuberculosis, among other diseases. One individual, PU517b, displayed extensive dental enamel defects.

The skeleton was aged based on dental development (Ubelaker, 1989) and diaphyseal length measurements using the standards developed by Stloukal and Hanákova (1978). The latter method was deemed appropriate for application in the case of PU517B, as it was developed on a 7th–9th centuries AD Slavic population from the Czech Republic and was tested in comparison to modern subjects and skeletal samples from Central and Eastern Europe (Bernert Zs Evinger and Hajdu, 2007; Pinhasi et al., 2011). Recording of dental and osseous pathological features was conducted using the guidelines from Buikstra and Ubelaker (1994), Steckel et al. (2011), and Ortner (2003). Developmental timing for dental defects was macroscopically estimated based on the methods of Reid and Dean (2000, 2006) and Hassett (2014). Sex was not estimated.

All bones were washed, dried and analyzed macroscopically, sometimes with the use of a lamp and magnifiers. Measurements were recorded using a digital spreading caliper. To better see the dental lesions, microscopic imaging was undertaken using a stereomicroscope and scanning electron microscopy (SEM).

3. Results

The skeleton is represented by fragments from the skull, maxillary and mandibular bodies, sternal vertebrae, ribs, and the left scapula, humerus, ulna, and femur. The remains preserve a mixed dentition, including the upper right first deciduous molar and the following elements of the permanent dentition: upper left second molar, upper left first molar, upper left second premolar, upper left first premolar, upper left canine, upper left lateral incisor, upper left central incisor, upper right lateral incisor, upper right canine, upper right first molar, upper right second molar, lower right second molar, lower right second premolar, lower left first molar. Based on dental development, the child's age at death was estimated to be between 7 and 8 years, with a standard error of 24 months (Ubelaker, 1989). By using the measurement of the right humerus, age at death was estimated at approximately 4 years. The discrepancy between the dental and skeletal ages could presumably reflect the greater impact of stress insults on skeletal growth and development, in comparison to the more robust dental structures (Anderson et al., 1976). Nevertheless, the development of the dental enamel was also seriously affected (Fig. 1).

The left upper first deciduous molar presents a resorbed root as well as a carious lesion along the cervico-enamel line. The permanent upper left central incisor displays hypoplastic lines and pits, as well as a considerable reduction in both its labiolingual and mesiodistal diameters in the upper half of the crown (Fig. 1). The same type of defect can be seen on the permanent upper left

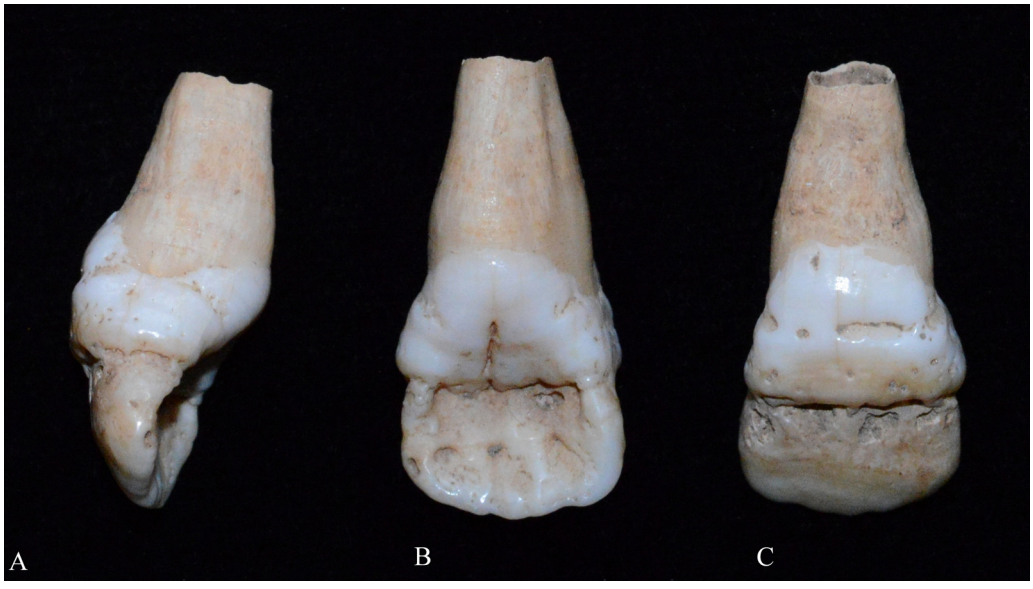

Fig. 1. The permanent upper left central incisor, showing linear and pitted defects on the interproximal (A), lingual (B), and labial surfaces (C).

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