



Review

Presence of dental signs of congenital syphilis in pre-modern specimens

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ABSTRACT

Objective: Tooth morphology can vary due to genetic factors, infectious diseases and other environmental stresses. Congenital syphilis is known to interrupt tooth formation i.e. odontogenesis and amelogenesis, producing specific dental characteristics. Variation of those characteristics can occur, resulting in dental signs “not typical” of the disease, however, they are described in the 19th century literature. Past treatments of congenital syphilis with mercury also interrupted dental processes resulting in significantly different dental signs. The aim of this study is to examine the dentition of the oldest (pre 15th century) cases attributed to congenital syphilis to determine whether their dental processes have been affected by either congenital syphilis itself, its treatments (mercury) or a combination of both (syphilitic-mercurial).

Design: Comparisons of dental signs of congenital syphilis and its mercuric treatments as described by Hutchinson, Moon and Fournier in the 1800s and in standardised methods as established by modern studies, are made with the dentition of specimens found in archaeological sites in Mexico, Italy, Turkey and Austria dating back to the Terminal Formative Period, Classical Antiquity, Byzantine times and Middle Ages.

Results: The dentitions of a child from Oaxaca, Mexico, St. Pölten, Austria, and two juveniles from Classical Antiquity site Metaponto, Italy, show signs attributed to syphilis only. One adolescent from Byzantine site Nicaea, Turkey, shows dental signs characterised as syphilitic-mercurial.

Conclusions: Dental abnormalities observed in Mediterranean individuals match a range of signs attributable to congenital syphilis and its treatments, more so than the New World case. Therefore, it is likely that these individuals suffered from congenital syphilis.

1. Introduction

Human odontogenesis, although regulated by genetic factors, also depends on the interaction with pathogens, and the quality of nutritional and physical environments. The tooth crown is shaped by amelogenesis, which has two stages, the secretory stage and maturation stage. Disruptions of enamel matrix formation tend to produce hypoplastic defects such as pits, grooves and thin or even missing enamel (Seow, 2015). Their appearance on the crown surface depends on the stage of tooth development affected and the duration of an insult. The location of the defect on enamel is a good indication of the approximate time the insult occurred (Seow, 2015).

Congenital syphilis is known to interrupt tooth and enamel formation, producing specific dental characteristics. Hutchinson (1859, 1863, 1887, 1888), Moon (1877, 1884), and Fournier (1886), have described specific dental signs (notched incisors, dome shaped molars and noduled molars) that they observed in individuals with congenital syphilis during the 19th century. However, variations of those characteristics

can occur, resulting in dental signs that are “not typical” of the disease (Hutchinson, 1878, 1888). Numerous descriptions of dental signs have been made (Bradlaw, 1953; Putkonen, 1962) to establish a standardised method determining dental signs of the disease to aid in its diagnosis. A standardised method widely accepted and used today had been established by Hillson, Grigson, and Bond (1998). Dental changes known to occur to the permanent dentition associated with congenital syphilis include (1) Hutchinson’s incisor that primarily affects the permanent upper central incisors, and occasionally some lower incisors, (2) Moon’s molars, (3) Fourier’s molars which demonstrate a defect cutting into the base of the cups and (4) canines with a groove-like defect around the tip of the crown (Hillson et al., 1998). Since enamel does not remodel, dental changes are important in archaeological and paleopathological collections.

Signs that are characteristic for a disease (pathognomonic) by definition cannot occur as a result of other diseases, thus their findings produce reliable diagnosis on their own. Re-examining the original works of Hutchinson (1859, 1863, 1887, 1888), Moon (1877, 1884),

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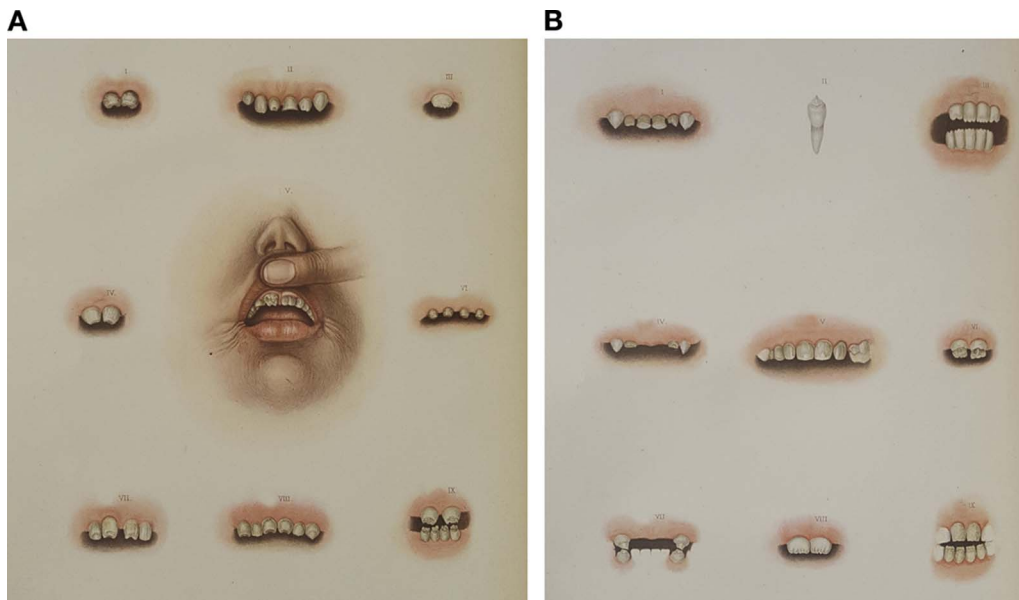


Fig. 1. (A) Plate XLII: Variation of dental malformations in untreated patients with congenital syphilis observed by Hutchinson (1888: p. 9). (B) Plate XLIII: Figs. I, II, IV, V and VII: variations of syphilitic teeth. Figure III: normal teeth with normal serrations. Figure VI: "craggy teeth", where enamel is missing on the lower half of the upper central incisors with distinct transverse demarcation separating healthy from affected enamel. Fig. VIII: Malformations caused by scrofula. Figure IX: Mercurial teeth. Hutchinson (1888: p. 15).

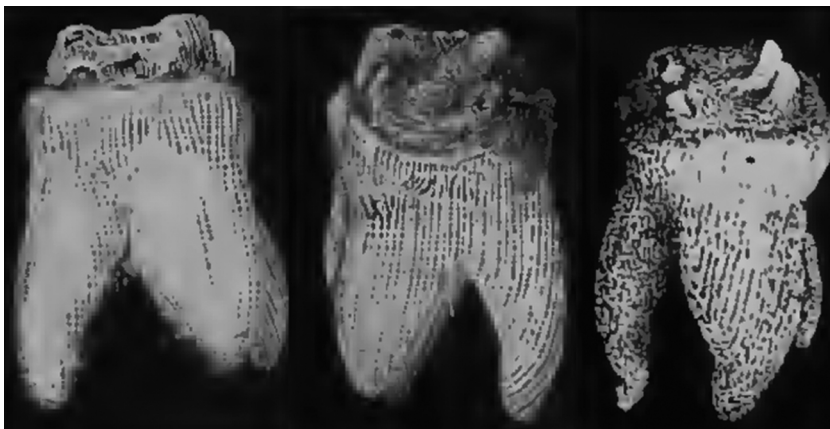


Fig. 2. A variation of syphilitic molars observed by Alfred Fournier (1886: p. 84 & 85, Figs. 7, 7A and 8).

and Fournier (1886), it has turned out that they also documented a spectrum of variations among well diagnosed patients that was wider than Hutchinson's incisor, Moon's molar, and Fournier's molar as hitherto used. The spectrum included notches on the edges of lateral and lower incisors and tips of canines, severe hypoplasia of their crowns, and hypoplastic patterns of nodules, groves and pits on the occlusal surfaces of first permanent molars. Recent paleopathological studies (Ioannou, Henneberg, Henneberg, & Anson, 2015; Nystrom, 2011) of skeletal remains of 19th century individuals demonstrated this wide variation of dental changes related to congenital syphilis.

Among pre-antibiotic treatments, the most widely used for syphilis was mercury and its compounds (Fournier, 1889; Hutchinson, 1874, 1878, 1887; United States. Public Health Service. Division of Venereal Diseases, 1930). Mercury produced widespread severe enamel hypoplasia not only on the first permanent molars, but also on incisors and in some cases on canines (Hutchinson, 1878). Premolars were rarely affected. These changes were the result of disrupted amelogenesis that produced deep irregular pitting and irregular enamel with patches of exposed dentine. Dental abnormalities caused by mercury were so substantially different from those produced by congenital syphilis itself that Hutchinson (1878) and later Moon (1884) deemed them worthy to document. However, the effects of treatment, the "mercurial" changes, have never been used as a diagnostic method in paleopathological diagnoses until recently (Ioannou et al., 2015; Ioannou, Sassani, Henneberg, & Henneberg, 2016). The new approach of using jointly

dental defects caused by congenital syphilis and its treatments as criteria of differential diagnosis can be now applied to assess the oldest paleopathological cases suggested in the literature to be those of congenital syphilis. Providing a strong diagnosis of congenital syphilis in these pre 15th century cases may contribute to the debate on the origins of the disease (Cockburn, 1961; Goff, 1967; Hackett, 1963; Harrison, 1959; Harper, Zuckerman, Harper, Kingston, & Armelagos, 2011; Holcomb, 1935; Hudson, 1963), and the antiquity of the mercurial treatment. The aim of this study is to re-assess the dentition of the oldest cases attributed in earlier publications to congenital syphilis in order to determine whether their dental development processes have been affected by either congenital syphilis itself, its treatments (mercury) or a combination of both (syphilitic-mercurial).

2. Materials & methods

A database search of PubMed and Google Scholar was conducted to find the oldest possible cases of congenital syphilis with dental abnormalities. Search criteria that were used included dates of cases prior to 1492, words: syphilis, congenital, dental, treponemal, (and their equivalents in European languages other than English) and the requirement that a publication contained photographs of dental changes of sufficient quality to allow independent assessment of these changes.

This search has revealed three cases: one from North America, one from Central Europe and one from Anatolia in addition to our own

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