The History of European Oral Health: Evidence from Dental Caries, Dental Abscesses, Antemortem Tooth Loss

AAPA Symposium
Reconstructing Health and Disease in Europe: The Early Middle Ages through the Industrial Period

Background

Oral health is an important indicator of diet, economy and quality of life. Most accessible indices are those derived from the observation of carious lesions, antemortem tooth loss and alveolar abscesses. This contribution focuses on the first two of these sources.

Introduction

Dental caries is closely connected to diet, especially high intake of carbohydrates. An essential turning point in Central European dietary habits was the shift from hunting and gathering to agriculture during the Early Neolithic (Wittwer-Backofen & Tomo 2008), featuring high correlations between the consumption of carbohydrates, wheat grinding techniques and caries intensity (Roberts & Cox 2003).

Further increases in caries frequency can be expected with the introduction of cane sugar from colonial trading around 1500 AD and the extraction of sugar from beets starting in the early 19th century.

Poor hygiene, a lack of certain trace elements or highly abrasive food particles may also promote caries.

Severe lesions often result in antemortem tooth loss or alveolar abscesses, which are serious, and potentially fatal, restrictions on the quality of life.

Differences in caries frequencies between males and females have been observed both in modern (Alvarez-Arenal et al. 1996) and Neolithic populations (Larsen 1998, Lukacs 1996).

Materials and Methods

Dental data is available from 10,003 individuals within the data base and have been explored for chronological trends, regional variance, age-relatedness and sex differences. To avoid shifts in caries and antemortem loss frequencies due to different age distributions in time periods and regions, we used standardized decade age groups starting above 20 years of age. Only sites represented by more than 100 observable teeth have been considered to avoid bias by small sample sizes.

Spatial analyses were based on a subdivision of Europe into four regions with distinct climatic conditions (Fig. 1) following long-established schemes (Kottek et al. 2006). These regions are also known to be archaeologically distinct for long periods of time.

Figure 1: Climatic regions within Europe used for the spatial analysis of oral health data and referred to in other graphs (Kottek et al. 2006; Neef as presented in Dierke 2008).

Results

Age-relatedness

As expected, caries affliction increases with age. This steady trend is little influenced by other factors. Additionally, the increase is linear, i.e. the increments are similar both for older and younger ages.

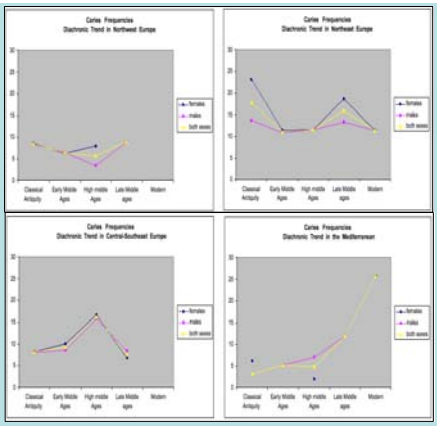

Figure 2: Diachronic trends in caries frequencies according to region. The cumulative curve labeled 'both sexes' includes skeletons for which sex could not be determined. These are not represented in the 'male' and 'female' curves. All data has been standardized for each age group to avoid bias through varying age distributions.

Regional Trends

Figure 2 presents diachronic trends in caries frequency by regions. In general, frequencies are higher in Northeast and Central Southeast Europe than in the Northwest and the Mediterranean. While the latter shows a marked increase towards the modern period (based on a small sample) a similar trend could not be verified for Northwest and Central Southeast Europe due to lack of data. It is absent, however, from the Northeastern sample.

Central Southeast Europe differs from the other regions in that caries frequencies peak during the High Middle Ages followed by a considerable drop towards the Late Middle Ages. Otherwise an opposite pattern prevails with a rise of caries frequency towards the Late Middle Ages.

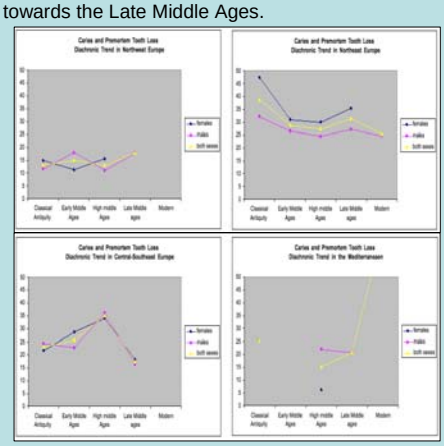

Figure 3: Diachronic trends in caries and premortem tooth loss frequencies according to region. The values were added up taking into account that the frequencies for caries and premortem tooth loss are calculated drawing on different totals (number of teeth vs. number of tooth positions observed). Where data for either caries or premortem tooth loss was not available no value has been given. The cumulative curve labeled 'both sexes' includes skeletons for which sex could not be determined. These are not represented in the 'male' and 'female' curves. All data has been standardized for each age group to avoid bias through varying age distributions.

Sex Differences

In Northeast Europe females are more strongly afflicted by caries and antemortem tooth loss than men. However, this trend is not very pronounced and not at all universal.

Caries and Tooth Loss

Severe carious lesions ultimately lead to antemortem tooth loss. Such cases consequently do not appear in caries statistics; therefore these missing data do not reflect the full impact on a population. For a more accurate assessment caries and antemortem tooth loss frequencies have been summed (Fig. 3).
These figures confirm the general patterns already discussed for caries frequencies in Figure 2 at a higher level. The higher caries rate in Northeast Europe is connected to a high rate of tooth loss.

Left: :"Der Zahnbrecher" ('The tooth breaker') 1568.
Right: "The old German tooth breaker. Which excruciates - or should I say cures - the hypocritical dishonest swanks and eaters of confectionery (because they have developed black, stinking, worm-eaten, bad teeth by it) according to fashion and better than any charlatan". 1632.

Discussion and Outlook

- Spatial analysis has shown a distinct development in Central Southeast Europe that contrasts with other regions. Caries and antemortem tooth loss frequencies peak here considerably earlier and subsequently decrease towards the late Middle Ages; this runs against all trends elsewhere. Further analysis will concentrate on possible factors for this shift. While economy may explain diachronic developments, geographic and climate factors are more likely to illustrate regional disparities.
- Sugar consumption obviously had moderate effects on caries and tooth loss until the modern period. If the import of cane sugar was relevant, this would have been expected to be exhibited earlier in coastal regions than in Central Southeast Europe. The sharp increase of caries and antemortem tooth loss in the modern period in the Mediterranean might indicate a change in consumption following the introduction of beet sugar.
- The decline in oral health from the Northwest to the Northeast might reflect general climatic factors causing adverse living conditions in the east.
- A major difference between the sexes could not be found.
- While these results are based on an unprecedented amount of data, further analyses are needed to complete the picture. For example, the Mediterranean sample needs to be increased to gain better spatial and diachronic coverage. Data for the modern period are also needed for Northwest and Central Southeast Europe to determine whether a deterioration of oral health similar to that witnessed in the Mediterranean can also be found there. Additionally, the inclusion of earlier periods would allow for tracing the history of oral health from the major impact of the Neolithic transition to 'modern' sugar consumption.

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