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Prevalence of dental caries in Hadrianapolis medieval population (X. century) *

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Abstract

Dental caries has been one of the major oral health problems of the human race since the Stone Age. The skeletal remains were found during the archeological excavations in Hadrianapolis region by Edirne Museum between 2002 and 2003. These were linked to Eastern Roman-Byzantium period. Thirty-seven skeletal remains out of total 139 were studied. The aim of this study was to determine the number of teeth with cavities and the prevalence of dental caries in the skeletal remains of Hadrianapolis inhabitants from X. century using the DM(F)T index.

Keywords: dental caries; ancient populations; Hadrianapolis; DMFT index; Eastern Roman-Byzantium

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Introduction

One of the major oral health problems of human race is dental caries, which is one of the most prevalent chronic dental diseases around the world. The requirement of treating dental caries was acknowledged even in the historical times (1-3). In a study conducted on human skulls from the Stone Age revealed 14 % of dental caries. There were cystic defects, sinus tracts, heavy deposits of calculus covering teeth, and teeth abrasion at high levels due to raw, underdone or less ground food on these skulls as well (2). Historians believe that there were 3 dental applications during the Neolithic period: 1. Tooth extraction by grasping with fingers, 2. Chewing herbs to relieve pain, and 3. Filling carious cavities with gravel dust or crumbled horn powder (2). Herbal remedies were kept being used during medieval times; however during the Roman period infections were cleaned by drilling the cavity (1,2).

Oral and dental pathologies have always been an issue of interest for bioarcheological and paleopathological research through skeletal remains of past civilizations. The variation of oral health within a population according to age, sex, diet, social status, and how oral health was altered over time is a particular interest to investigators for years (4). Many index systems have been developed along with the improvements in dentistry. The DMFT index (Decay-Missing-Filled Teeth index) is one of the most commonly used epidemiological indices in dental sciences which mirrors oral health in various populations. It is also acknowledged as the caries index and has been used since 1930s to estimate the prevalence of dental caries (5). Since 1938, the DMFT index has become a relevant tool in monitoring dental caries; applied by the World Health Organisation (WHO) in their assessment of oral health, reflecting the intensity or frequency of dental caries (6). The DMF Index is applied to the permanent dentition and is expressed as the total number of teeth or surfaces that are decayed (D), missing (M), or filled (F) in an individual. When the index is applied to teeth specifically, it is called the DMFT index, and scores per individual can range from 0 to 28 or 32, depending on whether the third molars are included in the scoring. When the index is applied only to tooth surfaces, it is called the DMFS index, and scores per individual can range from 0 to 128 or 148, depending on whether the third molars are included in the scoring (7).

The aim of this study was to determine the number of teeth with cavities and the prevalence of dental caries in the skeletal remains from the first salvage excavation of Hadrianapolis inhabitants from X. Century AD.

Historical Background

Edirne, formerly known as Hadrianople, is located on far west of Turkey lying on the border with Greece and Bulgaria (8). The first residents of the city were Thracians and it was overtaken by Romans following Greek domination. During that period it gained strategic importance due to its location and maintained this importance from Byzantine period to Ottoman Empire and today (9). One of the largest towers of Edirne Castle, the Macedonian tower is located in the northwest of Turkey. The first archaeological excavation at Hadrianopolis region was performed in a small area around the Tower by Edirne Museum as salvage excavation during 2002-2003. The excavation was executed in order to reveal the connections between the Tower and the fortification walls of the Castle (10). The skeletal remains found were related to Eastern Roman-Byzantium period (Figure 1) (3).

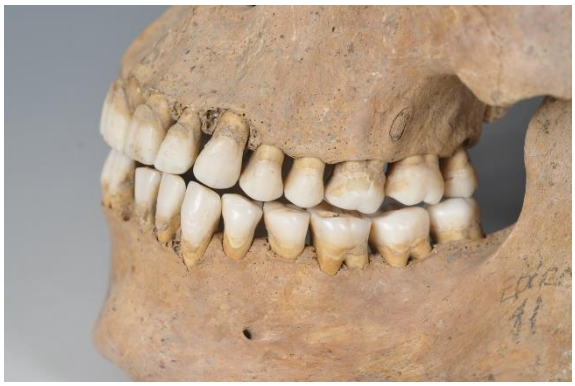

Figure 1. Hadrianapolis skeletons by Edirne Museum during 2002-2003 were related to Eastern Roman-Byzantium period.

Material and methods

Most of the skeletal remains were missing big pieces of bones (e.g. mandible which is used for sex determination) or broken. The sex and age of death could not be identified in all skeletons due to inadequate storage conditions and bones' being discovered separately. Out of 139 human skeletal remains, only 37 were sufficient with most of the teeth still present, so these were studied. Among the 37 skeletal remains, both jaws were present in 31 and one jaw or parts of a jaw were present in 6. One skeleton had no teeth

on either jaws. Therefore, maxillary and mandibular bones of 37 young adults, adults, and elderly sex identified skeletons.

In earlier paleoanthropological studies, the sex identifications of Hadrianopolis skeletons were performed by analyzing body bone epiphyseal junction for young adults; costal, symphyseal, sutural and dental aging for adults (11). This study was conducted on the upper and lower jaws of young adults (18-25), adults (25-45), and elderly (over 45). All morphological aspects, especially cranial and pelvic differences were taken into consideration for sex determination. The criteria were; cranial indicators including alterations in prominence of supra-orbital torus and nuchal lines, sharpness of the superior lateral margin of the orbit, parietal and frontal bossing, the extent of mastoid process and supra-mastoid eminence, and the sagittal contour of the frontal bone from glabella to bregma.

The numbers of decayed and missing teeth were recorded using the DMT index, which is the part of the DMFT index where fillings are not included, as recommended by the WHO for preindustrial populations (12). The skeletons were evaluated manually using a dental probe under bright light. The sorting of the index is as follows: Unerupted teeth, congenitally missing or supernumerary teeth, teeth extracted for other reasons than caries, and primary teeth retained in the permanent dentition are not counted. When carious lesions and a restoration are present, the tooth is recorded as a D. When a tooth has been removed due to decay, it is recorded as an M (7). The index has been used for almost 80 years and is well established as the key measure of caries experience in dental epidemiology and that is the reason why it was used in this study.

Results

The distribution of 139 individuals according to age was as follows: 7.91% elderly, 22.31% adults, 10.08% young adults, 3.59% teenagers, 17.27% children, 17.99% babies and 18.70% were unidentified. This distribution revealed that only 7.91% of the population survived over age 45. Meanwhile, the average age of death was 34.82.

Among the studied 37 sufficient skeletons out of 139 human skeletal remains, 24 skeletons belonged to male individuals and 13 to women (Figure 2). The mean age of death was 36.96 for males and 30.88 for females. The age groups, number of teeth, ante-mortem tooth loss, and decayed teeth are presented in Table 1. The distribution of individuals in each group is presented in Figure 3. The percentage values of post-mortem tooth loss were as follows: 34.9% for young adults, 35.9% for adults, and 19.6% for the elderly. The total number of post-mortem tooth loss during archeological excavation was 333. The number of teeth with dental caries had the highest value in adult group. The elderly followed, where ante-mortem tooth loss was higher than adult group. One of the skeletal remains with decayed and lost teeth is represented in Figure 4.

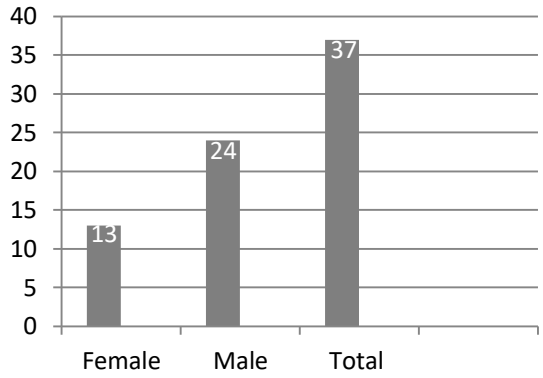

Figure 2. Distribution of sex in the study group.

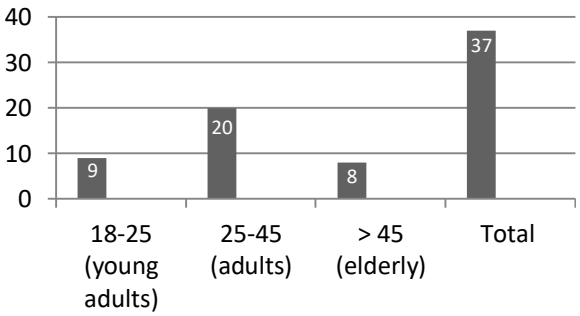

Figure 3. Number of individuals in each group.

Discussion

The formation of dental caries is a complex interaction between bacteria that produce acids and fermentable carbohydrates. Host factors like teeth and saliva also take part in the process. The decay may occur in either the crown or the root of the tooth. Biological, behavioral, environmental, physical, and factors related to life style such as cariogenic bacteria in high numbers, deficient salivary flow, insufficient oral hygiene, inappropriate applications while feeding infants and poverty are included in the risk factors for dental caries development (13). Studies indicated that changes in diet towards a richer

carbohydrate diet, including starches and grains for example, might have occurred even before the Neolithic Age. The number of carious lesions increased with the origination of agriculture (1). The increase in prevalence of tooth decay is believed to have arisen from cultivation and possibly cooking cereals. Cooking makes the food softer and more susceptible to sticking on teeth. Moreover, this makes carbohydrates more cariogenic (14). The food consumption varied by class in Byzantine. The wealthy populations could enjoy spices, honey-cakes, and other sweet food; however the diet of all included bread, vegetables and cereals prepared in various forms (15). The archeological data indicated that the nutrition of the population mainly consisted of dried meat and fish; but the consumption of food such as dried figs and honey was considered to be the probable cause of the inclination in carious lesions and ante-mortem tooth loss (4). The carbohydrate and/or sugar-rich nutrition might be the reason of dental caries. The changes in diet may have a negative impact on teeth (16).

Figure 4. Dental caries and tooth loss observed on skeletal remains.

The cracks in enamel and shape of wear of the anterior teeth may suggest that the people of Hadrianapolis might have been using their teeth as tools for pulling action during making fish-nets or ropes (4). This may be another explanation for the high ante-mortem tooth loss as well as the increase in caries since cracks or wear of enamel would lead to susceptibility to carious lesions.

The caries prevalence was higher in adult group than elderly. However, the ante-mortem tooth loss was higher in the elderly group. That is possibly because decayed teeth were being extracted at older age. This was in compliance with a study conducted in Portuguese identified skeletal samples (17). Out of the 596 teeth present, 218 teeth (36.6%) had a caries cavity, which may be considered a low rate.

The oldest known example of a dental filling belongs to the remains of a young man. It was found in a cave in Trieste, Italy. The early dental filling discovered in one of his teeth was made from beeswax and it dates back 6000 years (18). However, no sign of fillings were observed in any of the 596 teeth of 37 jaws of individuals from 10th century. This implies that fillings were not commonly used during that period in the region of Hadrianapolis. Depending on this outcome along with the tooth loss, it may be concluded that fillings were not an option in treating carious lesions.

In conclusion, there is an inevitable interest in studying the prevalence of dental caries, tooth loss, and other dental problems in ancient populations. The research may help us draw beneficial conclusions about life conditions in the ancient past. Therefore, more studies on skeletal remains are needed.

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Table 1. The distribution of individuals by age, number of teeth, and number of decayed teeth.

Age (year)	Number of teeth (%)	Number of decayed teeth (%)	Number of ante-mortem teeth loss(%)
18-25 (young adults)	163 (64.7)	21 (9.6)	1 (0.4)
25-45 (adults)	335 (59.8)	152 (69.7)	24 (4.3)
>45 (elderly)	98 (43.8)	66 (30.3)	82 (36.6)
Total	596	218 (36.6)	107