



## Bulletin of the International Association for Paleodontology

Volume 17, Issue 2, 2023

*Established: 2007*

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We thank all the reviewers for their effort and time invested to improve the papers published in this journal.

# Dental health of the historical adult population of Tver (12th-19th centuries, European Russia): Report 2\*

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**Bull Int Assoc Paleodont. 2023;17(2): 97-104.**

## Abstract

This is the second article of the series with the analysis of all known to-date data on the dental health of the historical adult population of Tver (12th-19th centuries, European Russia). Report 2 covers the antemortem tooth loss. Analysis is based on 1007 individuals (619 males and 388 females). All the groups ranging from the 12th to 19th centuries show high frequency of AMTL in both men and women. The percentage of AMTL in both genders increase to the 19th century due to the higher caries rated probably because of the better accessibility of simple sugars.

**Keywords:** dental health; antemortem tooth loss; European Russia; Tver

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## Introduction

Human bones in Tver (Figure 1) have been routinely collected and analyzed only since 90s of the 20th century (1). Excavations in four districts (Old Russian – posads) (Figure 2) of Tver brought a wealth of human osteological data. In addition to the rich material from Zagorodsky Posad (2-4), data from Zatveretsky Posad (5) and Tver Kremlin (stronghold) (6-9) have been obtained (Table 1, Figure 3). Although most of the mentioned publications include short paragraphs on the dental health of the analyzed period's population, the publication of 2021 (10) was addressed to the question of the temporal and gender-related aspects of caries in Tver population of the extensive period time from the 11th to 19th centuries. It also touched the subject of the lack of wisdom teeth. The objective of this study touches the related subject of the antemortem tooth loss (AMTL).

## Materials and methods

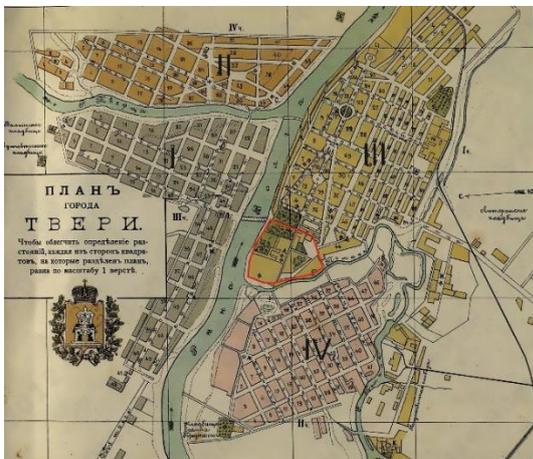
Table 1, modified from the publication of 2021 (10), shows the number of adult individuals (19+; the age range for which the sex for individuals was definitely confirmed) (619 males and 388 females), teeth of which were used for the analysis of AMTL of the historical Tver population (except for the Tver Kremlin, where the data was taken from the original unpublished research) (2-4, 6-8). Grey bars show the time span of the cemetery researched. The lack of M3 or wisdom tooth/teeth is reported as the percentage from the number of individuals of a specific gender-group. This information is essential for the analysis of AMTL. Data on AMTL is presented in a series of tables (Table 2A-E), where the AMTL is classified by site, sex, and side. Mean of AMTL for each side is marked by the corresponding dashed line. Statistical analysis is performed using SPSS 14.0 no Windows.



Figure 1. Map showing the position of cities, mentioned in the article.

## Results

The overall rate of ATML for the entire study sample is 11,6%. Table 2 (A-E) shows the tooth loss by site, sex, and side. Several patterns, which can be seen from the Table 2, are discussed below.



**Figure 2.** Fragment of the map of Tver from the City Guide of 1905, showing Kremlin (stronghold) (red outlines) and posads (districts): I – Zavolzhsy; II – Zatvetersky; III – Zagorodsky; IV – Za'tmatsky.



**Figure 3.** Mandible of 55-65 years-old woman from Tver Kremlin burials with signs of ante- and post-mortem tooth loss. 1st half of 16th cent.

## Discussion

The loss of teeth is a multicausal and complex process (11-13). Out of four primary casual factors that contribute to AMTL – (1) variations in dietary consistency, (2) nutritional deficiency diseases, (3) cultural or ritual ablation, and (4) trauma – only first seems to be the case for the studied population of Tver, although the second can also be partially considered in terms of the pregnancy disorders in women. There is no doubt

that citizens of Tver might have lost their teeth due to the trauma. Surprisingly, none of the skulls studied bore explicit marks of tooth loss due to this reason. This is the sample phenomenon. Further studies of anthropological material from Tver cemeteries will definitely fill the gap. In societies with the routinely practiced ritual combats, traumatic tooth loss sometimes constitutes a significant proportion of the entire tooth loss count (14).

Table 2A-E brings the median of frequency values of AMTL for men and women. For men the median is 13 for the left side of the jaws, and 11 for the right side of the jaws. For women the median is 10 for the left side of the jaws, and 13 for the right side of the jaws. The modes of values for men are 13 on the left side of the jaws, and 11 on the right side of the jaws. For women they were 8 on the left side of the jaws, and 13 on the right. Interestingly, men and women actually have diametrically opposed results.

One of the noteworthy patterns for the Tver tooth loss sample is the prevalence of the tooth loss on the right side of both jaws (Table 2A-E). There is no functional explanation to this feature at hand. Samples from other times and countries do not show the tendency to the right- or left-sidedness of the tooth loss on either jaw (see the review in 14).

The other feature is the prevalence of maxillary tooth loss over the mandibular. This is the general feature, recorded in many societies (see, for example, 15) and related, probably, to the morpho-physiological peculiarities of the human dental system itself. The feature is not sex-related.

The sex-related feature for the population of Tver is the frequency of the tooth loss. It is higher in women than in men. This is the most common pattern from females in various world populations (16-18 etc.). The most significant factor responsible for this situation is the hormonal fluctuations associated with pregnancy and monthly cycling (19). Female hormones influence the saliva composition and flow rates, which in turn affect the microbiology of the oral cavity.

The tooth loss in Tver population is prevalent in both sexes in postcanine teeth, namely in P2, M1 and M2. This is a typical situation for the human population, where the caries tend to be less prevalent in anterior teeth (14, 20, 21). The highest rate of P2, M1 and M3 loss in both sexes of Tver population correspond to the highest rate of caries in the corresponding teeth, reported earlier for this population (10).

**Table 1. Timespan of cemeteries, samples and the lack of M3 in Tver population of 12-19th cent. AD (after Zinoviev, 2021 with changes).**

location / sex (n)		century									Lack of M3 %	Source
		12	13	14	15	16	17	18	19			
Tver Kremlin	m (84)										-	4
	f (75)										-	
Zat'matsky Posad	m (88)										0,1	14
	f (44)										1,2	
Zagorodsky Posad	m (300)										0,4	
	f (175)										1,8	
Zagorodsky Posad	m (50)										0,0	10
	f (37)										0,0	
Zagorodsky Posad	m (12)										16,0	7
	f (2)										0,0	
Zagorodsky Posad	m (38)										2,6	8
	f (16)										0,0	
Zagorodsky Posad	m (13)										0,0	11
	f (14)										0,0	
Zatveretsky Posad	m (33)										0,0	12
	f (25)										4,0	

Gray bars show the timespan of burials

Table 2A, B. Percentage of the antemortem tooth loss by site, sex and side.

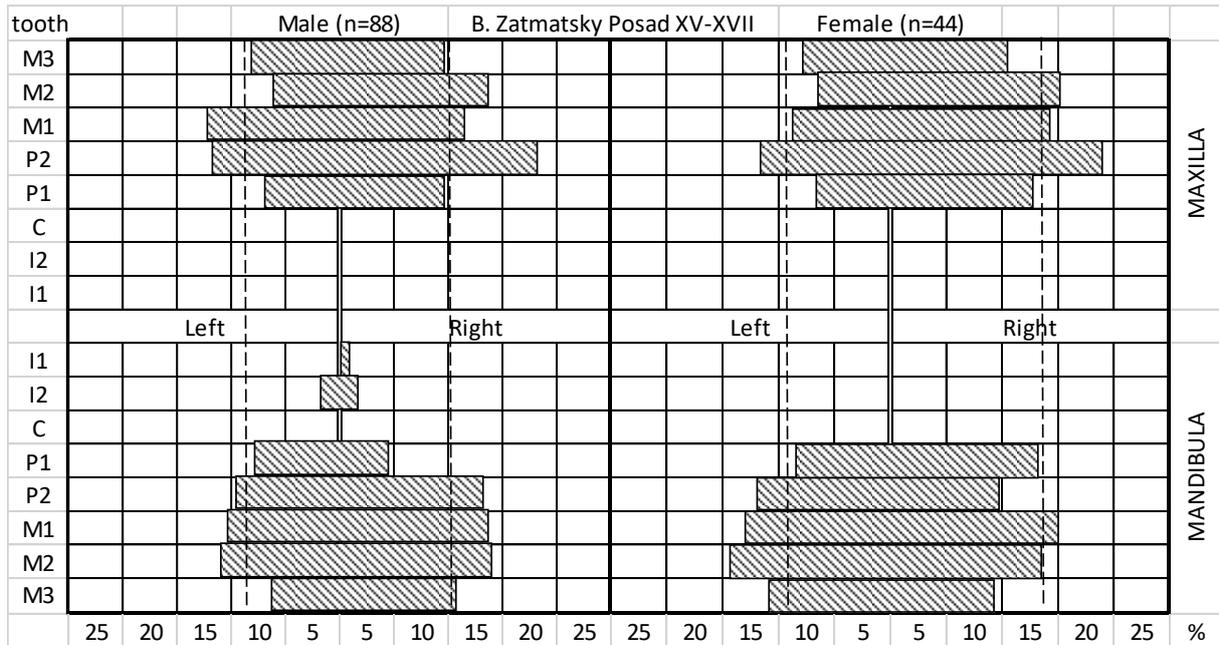
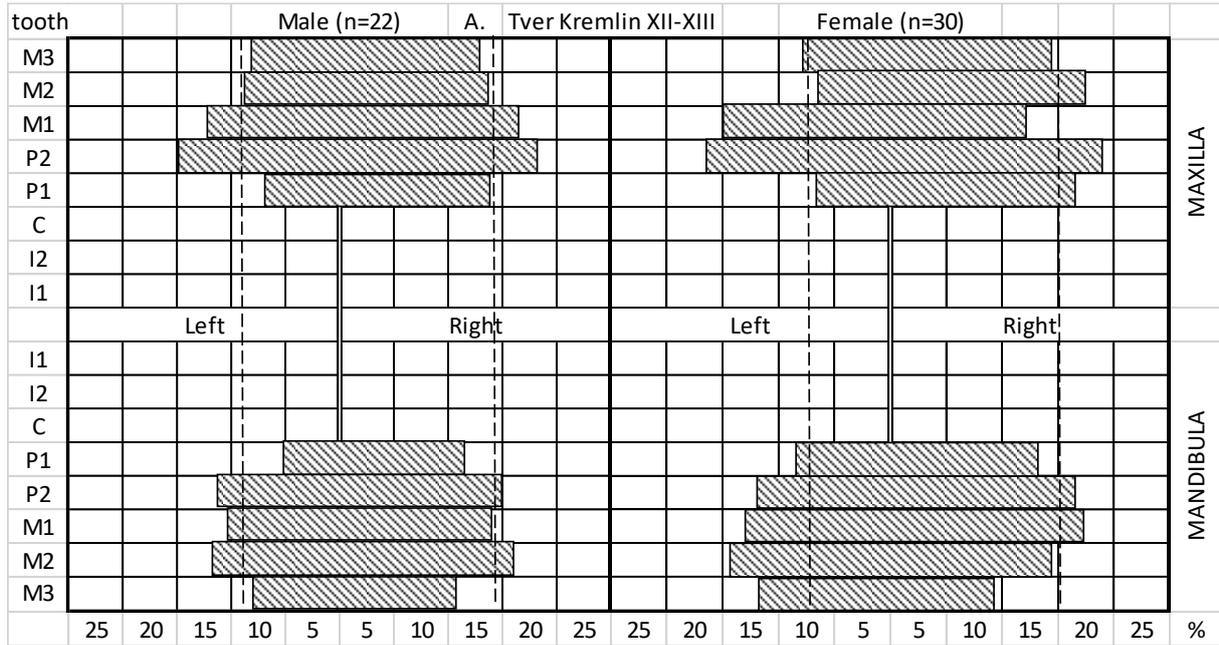


Table 2C, D. Percentage of the antemortem tooth loss by site, sex and side (continued).

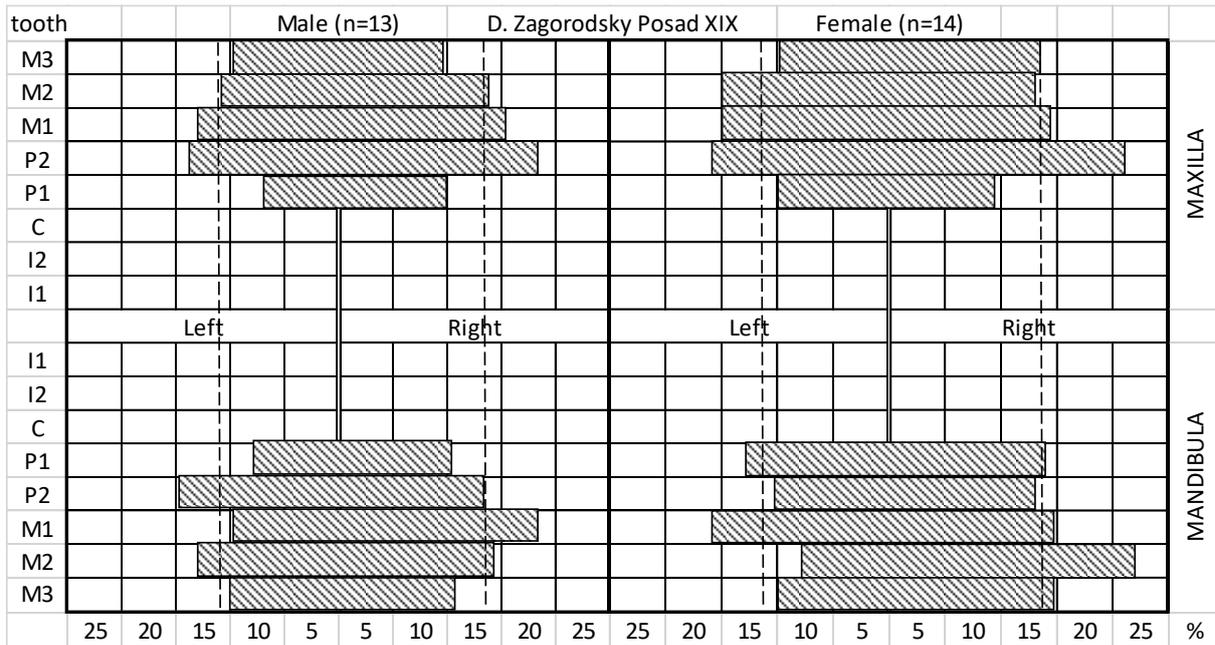
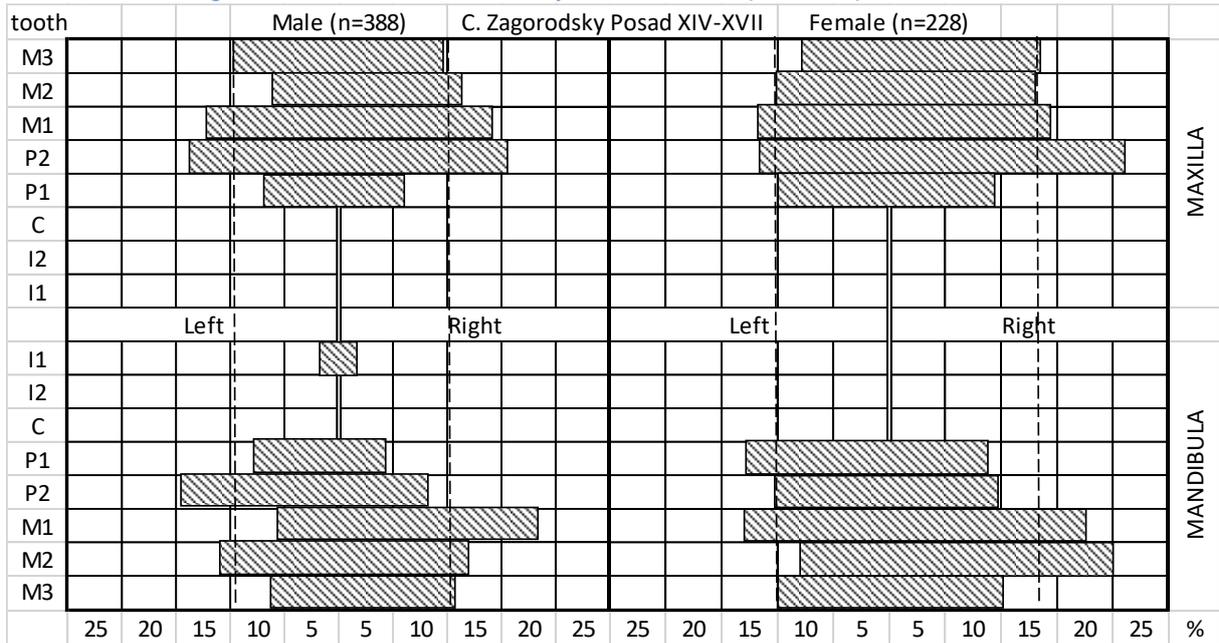


Table 2E. Percentage of the antemortem tooth loss by site, sex and side (continued).

tooth	Male (n=33)										Female (n=25)										%					
	Left					Right					Left					Right										
M3																										
M2																										
M1																										
P2																										
P1																										
C																										
I2																										
I1																										
	Left					Right					Left					Right										
I1																										
I2																										
C																										
P1																										
P2																										
M1																										
M2																										
M3																										
	25	20	15	10	5	5	10	15	20	25	25	20	15	10	5	5	10	15	20	25						%

Anterior teeth are rarely lost antemortem in Tver population. Only several cases of the loss of mandibular incisors in men are reported for cemeteries of Zatmatsky, Zagorodsky and Zatveretsky Posads (Table 2B, C, E). The traumatic case of mentioned losses cannot be excluded but obvious traces of trauma are absent.

There are some trends, related to the age and location of cemeteries. One of the highest tooth losses rates is reported for the earliest cemeteries of Tver, located in Tver Kremlin (Table 2A). This corresponds to the high rate of caries reported earlier for this cemetery (10). The unusually high rate of caries and related AMTL among individuals of the Kremlin cemetery is affected by the diet of high-rank people, which is rich in simple sugars. The ordinary people from the medieval Tver Posads were less affected by caries and thus by ATML (Table 2B, C). Higher accessibility of simple sugars in later times corresponds to the increase of ATML (Table 2D, E), which is the highest in the Zagorodsky Posad cemetery of XIX century.

### Conclusion

In conclusion it can be stated that all the groups ranging from the 12th to 19th centuries show high frequency of AMTL in both men and women. Women are affected more often though. The percentage of AMTL in both genders increase to

the 19th century due to the higher caries rated because of accessibility of simple sugars. A high level of AMTL due to the caries is also observed in the earliest cemetery from Tver Kremlin, where high-rank people were buried. AMTL due to the trauma is not recorded.

### Acknowledgments

I am grateful to Alexander Khokhlov (Tver Science and Research Archaeology and Restoration Centre, Tver, Russia), whose invaluable supply of osteological material made this study possible. I thank anonymous reviewers for suggestions that improved the manuscript.

### Declaration of Interest

None

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