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(Hrsg.)

Studien zum Burgwall von Mikulčice VIII

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Anthropological and epidemiological characterization of Great-Moravian population in connection with the social and economic structure

The State of Dentition in the Great Moravian Population – a Comparison of the Mikulčice Centre and its Hinterland

Petra Stránská[1] – Petr Velemínský[2] – Jana Velemínská[3]

The state of dentition is affected not only by endogenous factors (e.g. genetic predispositions), but also by exogenous factors, such as the quality of diet, its processing, or infectious diseases and trauma associated, among others, with the socio-economic status of the given population group. Thus, it also indirectly testifies to the living conditions of our ancestors. In our paper, we evaluated the primary indicator of the state of dentition- caries associated lesions and intra-vital teeth loss in adult males and females from three Great Moravian localities, the Mikulčice-Kostelisko burial site, the first burial site at Pršánky and from Josefov. Mikulčice-Kostelisko, located in the the sub-castle area of Mikulčice castle represents a population, where a higher social status and thus better living conditions of the persons buried there may be presumed. Pršánky and Josefov are burial sites in the Mikulčice centre hinterland. The group from Josefov is considered to be a peasant population, i.e. the poorer section of the inhabitants. In the case of Pršánky, taking into consideration the grave equipment, a peasant character of the inhabitants cannot be ruled out. Nonetheless, individuals with a richer grave inventory were also buried at this site. We used two indexes in our evaluation- the Index of Caries Frequency F-CE and the Index of Intensity of Caries I-CE. We correlated the incidence of caries and intra-vital loss with sex and age, for each burial site separately, and we subsequently compared the individual burial sites, also taking into consideration the presumed socio-economic status of the given population. We also verified the differences between the graves with poor and rich grave inventory. As expected, at all burial sites, females were more often affected than males. We determined significant differences only in the incidence of intra-vital losses. The correlation between the degree of affliction and age was confirmed. Significantly greater incidence of caries was recorded in individuals from poorer graves compared to individuals from richer graves. The socio-economically privileged Kostelisko population was characterised by less caries than both village populations.

Keywords: state of dentition – Great Moravian population – index of caries frequency – index of intensity of caries – socio-economic comparison – grave goods

1. Introduction

Dental anthropology – the study of the state of dentition – is today an integral part of the analysis of the skeletal remains of past populations. The state of dentition is affected not only by endogenous factors (e.g. genetic predispositions) (Fig. 5), which we are generally unable to grasp, but also by exogenous factors, such as the quality of diet, its processing or infectious diseases and trauma associated, among others, with the socio-economic status of the given population group. Thus, it also indirectly testifies to the living conditions of our ancestors. In view of the aforementioned "multi-factorial" aetiology, these results cannot be interpreted unequivocally. For example, we must always keep in mind the clear correlation of the state of dentition with biological age.

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Table 1. Dental disease (created from Kilian at al. 1999).

Teeth disease (hard tissue, pulp, periodont)				Parodontal disease	
Developmental		Acquired			
Type of disease	Possible causes	Type of disease	Possible causes P	Type of disease	Possible causes
hypoplasia	genetics, the maternal organism disease within the prenatal development, inflammatory, trauma	**caries**	infection, genetics, diet, dental attrition, dental abrasion, trauma, sex, age	**inflammation of gingival tissue**	infection, genetics, trauma, age, sex
dysplasia (fluorosis, amelogenesis imperfecta)		**intravital loss**		**parodontitis**	
hypomineralization		**pulpitis**		**parodont atrophy**	
tooth count variation (anodontia, hypodontia, hyperdontia)		**periodontitis**			
tooth size variation (mikrodontia, makrodontia)					
retention					
malocclusion					
tooth shape variation					
transposed teeth					

Table 2. Evaluated dentitions in each cemeteries.

	No. of individuals	No. of permanent teeth	No. of dental alveolus	No. of intravital losses	No. of postmortal losses	No. of retentions
Mikulčice-Kostelisko	208	3455	4996	565	969	7
Prušánky	121	1819	2929	583	529	0
Josefov	48	640	1060	169	251	0

Table 3. Demographic characterization of evaluated individuals.

	20-35	35-50	Over 50 years	In total
Mikulčice-Kostelisko				
male	25	41	13	79
female	62	55	12	129
in total	87	96	25	208
Prušánky				
male	5	26	14	45
female	20	37	19	76
in total	25	63	33	121
Josefov				
male	2	7	7	16
female	5	12	15	32
in total	7	19	22	48

We may divide the pathological states of dentition into two basic groups- diseases affecting the tooth itself and including hard tissues, pulp and the periodontium, and diseases of the parodontium (tissues associated with the tooth topographically or functionally). We then divide tooth defects into developmental and acquired. With the exception of congenital, hereditary defects, all other entities may indicate the degree of living condition optimality (Table 1).

Compared to classical osteology, the study of dentition has several advantages. Teeth are often preserved intact, i.e. they usually represent, from a statistical point of view, an adequate sample for the evaluation at the level of population groups. The quality of diet, eating habits have always been associated with the social status of a given population group. In the case of the Great Moravian burial sites studied, we thus attempted to evaluate dental pathologies in such a context. The data acquired thus creates a solid odontological database that makes the comparative analysis with other populations possible.

2. Materials

Our paper is devoted to the evaluation of the primary indicators of the state of dentition- lesions of caries and intra-vital tooth loss- in adult individuals from the Mikulčice-Kostelisko burial site, from the first burial site at Prušánky and from the burial site at Josefov. Periodontal disease (granulomas, abscesses) will be the subject of further research (Fig. 2, 5). Hypoplastic enamel defects have been published independently (e.g. Trefný/Velemínský this book, pp. 141-149). These burial sites have not as yet been processed archaeologically, or if they have been, then they not as yet been published.

Mikulčice-Kostelisko (henceforth Kostelisko) (9th-10th century) is the second largest Great Moravian burial site, located in the sub-castle area of Mikulčice castle. There is an assumption that is the burial site of the inhabitants of the forecastle (peasants, artisans and members of the higher social classes) (Poláček/Marek 1995;

Fig. 1. Josefov – grave 23. Intravital loss of major part of the mandibular teeth.

Fig. 2. Josefov – grave 70. Periapical lesions on roots of left second incisor and canine.

Fig. 3. Josefov – grave 70. Intravital loss of all right half maxillary teeth.

Fig. 4. Mikulčice – grave 1776. Probably posttraumatic intravital loss of both upper right incisors (the state of health of the other teeth is very good).

Fig. 5. Mikulčice – grave 2000. Large periapical lesion on roots of left upper molars.

Fig. 6. Prušánky – grave 150. Dental carries on right upper second molar. Rotation of right upper canine.

Velemínský et al 2005). Out of the 420 graves, we evaluated the state of dentition in 79 males and 129 females.

Prušánky lie around 9 km as the crow flies from Mikulčice castle. Six hundred seventy six graves dating to the Early Medieval Age, i.e. the Great Moravian period (9th-10th century – rural character of grave equipment, so-called "Prušánky1") and to the Late 'Hilfort' period (11th-12th century, richer grave equipment, so-called "Prušánky II") (e.g. Klanica 1977, 1980). The poorer character of grave equipment at the Prušánky I burial site indicates that this could have been a village burial site. Of the whole group that included 330 graves, there were 176 adults. We were able to assess dentition in 134 adult individuals, of which 45 were males and 76 females.

The archaeological research of the **Josefov** burial site was conducted by Eva Šráčková from the Institute of Archaeology of the Czech Academy of Science, Brno, between 1958 and 1961. One hundred seventy six uncovered graves were dated to the second half of the 9th century. This is a village burial site (Hanáková/Stloukal 1966), whereby we assessed the dentition of 16 males and 32 females out of the 167 individuals buried there (e.g. Stránská et al. 2002).

Thus, this study includes these localities with the following number of evaluated teeth and alveoli. In the case of retention, the third molars were not included, as molars were not x-rayed (Table 2).

The state of preservation of the material studied is characterised by two indexes – the comparative dental index (CDI) and the comparative alveolar index (CAI). The comparative dental index could correlate with the group quantity, while no such correlation could be found in the case of the comparative alveolar index, and it is thus more of an indicator of the overall preservation of the material (Stloukal 1963, Stloukal/Vyhnánek 1976). The values of our material were as follows – Kostelisko - CDI 66.5, CAI 75.1, Prušánky - CDI 60.6, CAI 75.6, and Josefov - CDI 58.0, CAI 69.0. The worst preservation involved the material from Josefov.

The basic demographic characteristics of the evaluated adult males and females are listed in Table 3. As we had at our disposal an adequate number of dentitions, enabling statistical evaluation, we did not include individuals who could not be identified in our calculations.

3. Methods

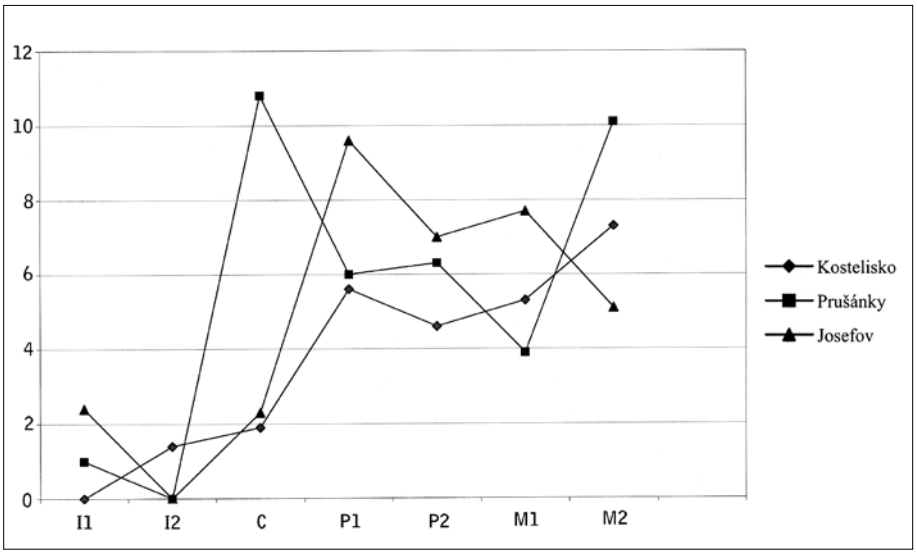
On the dentition of adult males and females, we evaluated the incidence of caries and intra-vital loss. Both characteristics can be easily observed macroscopically (Fig. 1, 3, 6, 7, 8, 9). In the case of carious lesions, we took into consideration only clear cavities and not microscopically white or brown blemishes immediately below the surface layer of enamel, which indicate the initial phase of caries (Hillson 1996). The consequence of caries is the progressive destruction of dental structures by bacteria, which over time leads to intra-vital loss. On the other hand, intra-vital loss need not always be caused by progressive caries. The absence of teeth may also be the consequence of an accident. This most often involves the front teeth (Fig. 4). Naturally, though, we were unable to recognise this, and thus we did not take this possibility into consideration in our evaluation. In our observations, we did not evaluate the third molars, in view of the difficulties ensuing from their equivocal presence or absence (Caselitz 1998).

We used the Index of Caries Frequency F-CE, which expresses the proportional representation of individuals (or rather the skulls studied) whose dentition has at least one caries or intra-vital loss, for our evaluation. Another indicator that informs about the overall number of teeth with caries out of the number of teeth found and about the number of healed alveoli following intra-vital loss out of the total number of preserved alveoli is the Index of Intensity of Caries I-CE. This index thus represents the sum of the percentage values of the incidence of caries and the incidence of intra-vital losses. In the case of very poor material preservation and the concurrent high degree of caries, the value of this index may reach truly illogical

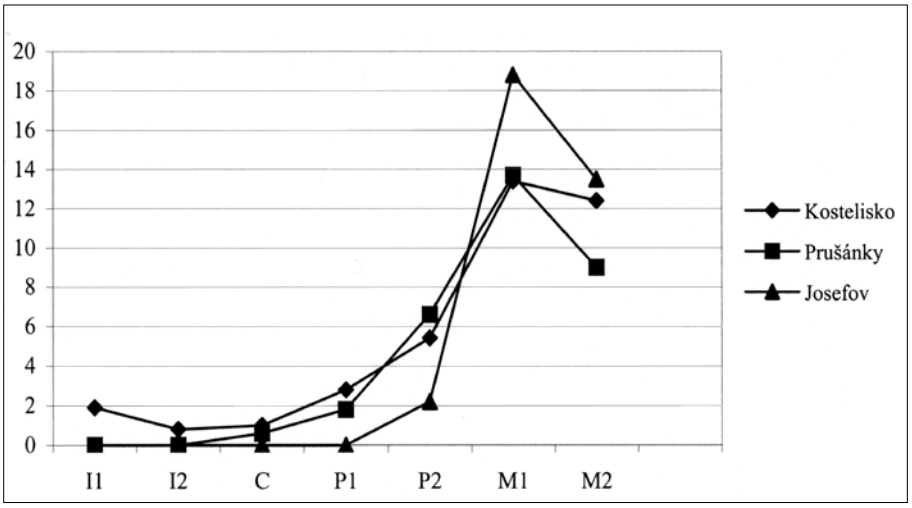
Fig. 7. Prušánky – grave 42. Intravital loss of all mandibular teeth.

Fig. 8. Prušánky – grave 97. Dental caries on right lower molars.

Fig. 9. Prušánky – grave 159. Intravital loss of nearly all maxillary teeth.

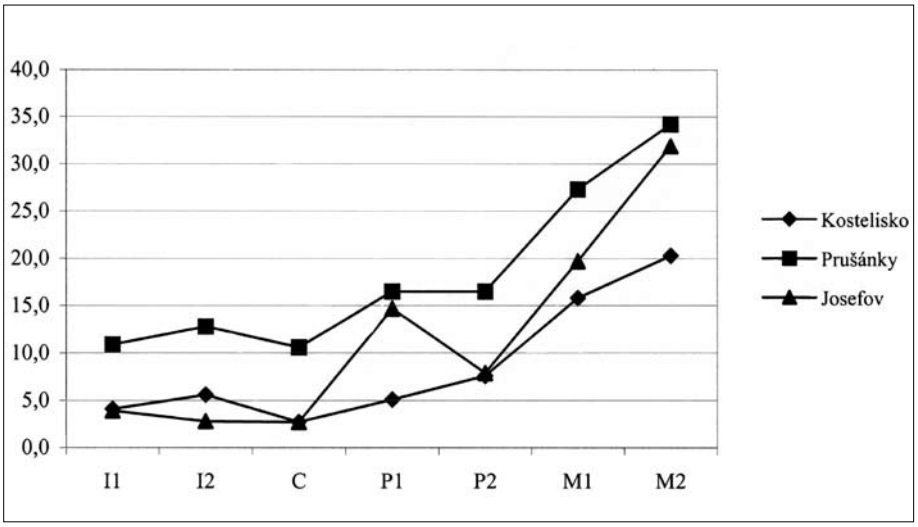


Graph 1. Dental caries in the individual teeth in maxila – adults.

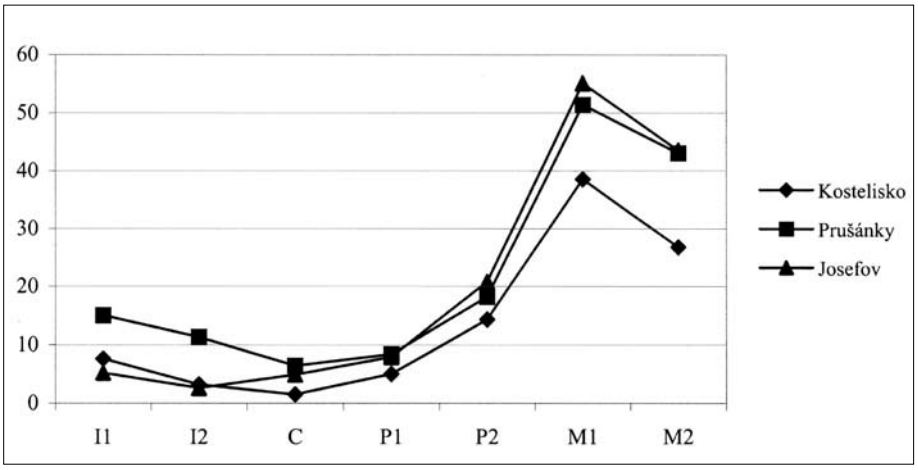


Graph 2. Dental caries in the individual teeth in mandible – adults.

values exceeding 100.0 (Stránská/Likovský/Velemínská 2005). Some researchers use only the expression of the proportion of carious teeth and the proportion of intra-vital losses in percent, without adding both values (e.g. Šlaus 2000, 2002). Other researchers use this index routinely to express the degree of teeth caries (e.g. Stloukal/Vyhnánek 1976; Caselitz 1998; Beňuš/Thurzo 2001; Bodoriková/Drozdová 2005; Bodoriková/Thurzo/Drozdová 2005). When using this method of evaluation of the incidence of caries and intra-vital losses, the result may be significantly influenced by the state of preservation of individual types of teeth, as molars are usually more affected by caries than front teeth, and molars are better and more often preserved. Thus, in the case of absence or poor preservation of the front teeth, there is a significant artificial increase in the proportion of carious lesions (Hillson 1996, Duyar/Erdal 2003). At the burial sites studied, though, all types of teeth were more or less uniformly represented, as shown in Tables 4-6. We thus presume that there was no significant distortion of results. There exist many various approaches and methods for evaluating dental caries (e.g. the Caries Rate calculation for every type of tooth, or the classical DM Index, Hardwick's correction, calculating by J.R.Lucacs 1995), which also depend on other factors (e.g. also on the manner of evaluation, what is included among the carious lesion) and are still the subject of much discussion (e.g. Costa 1980; Saunders/De Vito/Katzenberg 1997; Hillson 2001; Duyar/Erdal 2003). None of these methods is



Graph 3. Intravital loss in the individual teeth in maxila - adults.



Graph 4. Intravital loss in the individual teeth in mandible - adults.

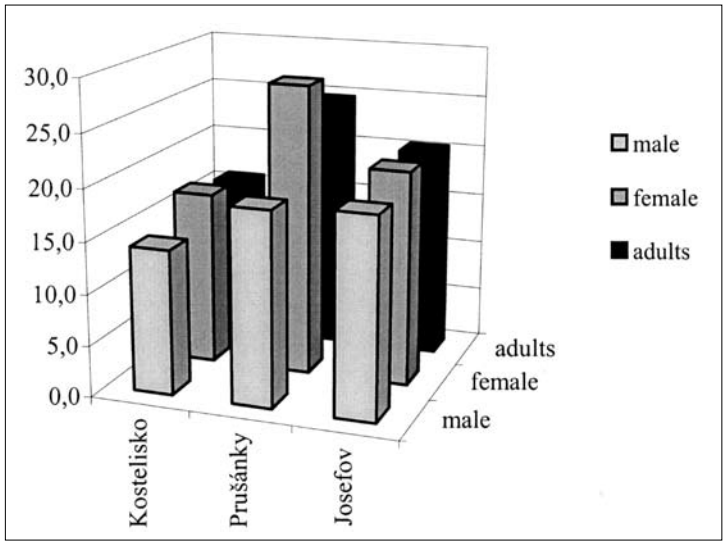
to date considered to be sufficiently precise. In our opinion, the greatest problem ensuing from such different approaches is the fact that it is impossible to compare different groups without revising and correcting the initial data.

We correlated the incidence of caries and intra-vital loss with sex and age, separately for each burial site. We subsequently compared the individual burial sites. We also compared the Mikulčice-Kostelisko population (where we presumed a higher social status) with the remaining burial sites of the Mikulčice hinterland – Josefov and Prušánky I (where we presumed a rural or peasant population). We also verified the differences between the graves with poor and rich grave inventories (Velemínský 2000) within each burial site. We consulted the statistical evaluation with RNDr. Karel Zvára, CSc. To test the null hypothesis, namely that cariousness of teeth does not differ among individual age categories, between the sexes and between poor and rich graves, we created contingency tables of nominal quantities, and we used Pearson's $\chi 2$ -test for the calculation. We considered the difference to be significant if $p \leq 0.05$, and highly significant if $p \leq 0.001$. We used the STATISTICA version 6 program for our calculations.

4. Results

4.1 Cariousness of individual types of teeth (Tables 4-6, Graphs 1-4)

The cariousness of individual teeth was generally quite diverse, ranging from 0.0% (mostly incisors) to 57.1% (M1 in females at Josefov). In all groups, the number of intra-vitally lost teeth



Graph 5. I-CE in all cemeteries.

exceeded the number of carious teeth, in the case of both jaws. It must be remembered here that most intra-vital losses of the front teeth are of mechanical origin, not as the consequence of caries. In the case of the upper jaw, the second molar was most frequently lost during life. In the case of the mandible, the first molar was the most frequently lost tooth, without exception. Overall, more intra-vital losses were located on the mandible, significantly so in females at all burial sites (Prušánky $p \leq 0.05$, Josefov and Kostelisko $p \leq 0.001$), and in males at Kostelisko ($p \leq 0.01$).

4.2 Frequency of caries (Tables 7-9)

Another analysed parameter was the number of affected individuals considering the overall number of individuals studied that is the frequency of caries expressed with the aid of the F-CE index.

The frequency of caries was highest in the case of Prušánky (79,4%), followed by Kostelisko (75,5%) and the least number of affected individuals was discovered at Josefov (69,2%). The uncovered data show that significantly more females were affected than males at all the burial sites. The values of the index increased only moderately with age. No statistically significant increase was recorded in males, while in females a significant difference was found at all the localities studied (Prušánky $p \leq 0.05$, Josefov $p \leq 0.05$, Kostelisko $p \leq 0.001$), mainly thanks to the proportional increase of females with intra-vital loss at a higher age.

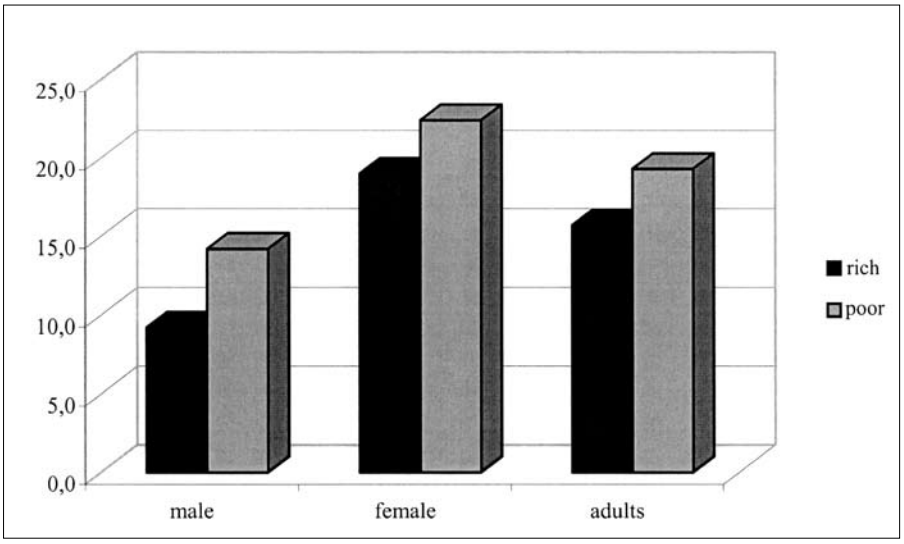
4.3 Caries intensity (Tables 10-12)

The amount of affected teeth and alveoli is characterised by the Index of Caries Intensity I-CE. We confirmed the hypothesis that the dentition of females is more affected by caries and intra-vital loss than that of males. Overall, we recorded the highest intensity of caries at Prušánky (24.7), followed by Josefov (20.4) and the most favourable situation was at Kostelisko (15.8).

As expected, our observation of the differences between individual age categories showed in all cases an increase in the value of the index with increasing age. This is associated with the increasing proportion of intra-vital loss, which at all burial sites was significantly higher in both sexes ($p \leq 0.001$), while the number of carious teeth showed an insignificant rising tendency, with the exception of females from Kostelisko ($p \leq 0.001$).

4.4 Comparison from the aspect of social status (Graph 5)

We based ourselves in our evaluation on the premise that the inhabitants buried at Kostelisko represent the middle and higher social classes, while those buried at Josefov and probably also at Prušánky were peasants and villagers. Of all the



Graph 6. I-CE in rich and poor graves – all burial grounds together.

parameters studied, we only found a significantly lower proportion of intra-vital loss in males and females at Kostelisko ($p \leq 0.001$) in both higher age categories, above 35. We reached the same results when we compared Kostelisko and the merged burial sites at Josefov and Prušánky.

4.5 Comparison of rich and poor graves according to the grave inventory (Tables 13-15, Graph 6)

We used Hrubý's five-grade classification (1955) and the more general Stloukal classification (1970) to determinate the graves (Velemínský 2000). Rich graves contained earrings, swords, axes, and other gold and silver objects, while poor graves contained for example vessels, whirls, beads, knives, flints, blades or they completely lacked any findings. We thus acquired two groups, which we could further subject to a comparative analysis. In view of the smaller numbers in the groups, we merged persons from individual age categories together.

In 31 rich graves from Prušánky (6 males, 25 females), we were able to assess 543 teeth, 802 preserved alveoli; in 17 graves from Josefov (6 males, 11 females) 233 teeth, 342 alveoli; and in 66 rich graves from Kostelisko (27 males, 39 females) 1238 teeth and 1602 alveoli.

A statistically significant difference in the number of intra-vital losses in both sexes was found in the case of all burial sites. When all burial sites were combined, we found significant differences between rich and poor graves, as well as in the number of carious lesions in both sexes ($p \leq 0.05$) and highly significant differences ($p \leq 0.001$) in the number of intra-vital losses.

5. Discussion and conclusion

The aim of our study was to evaluate the state of dentition in three Great Moravian populations in relation to the socio-economic structure of the given society. Mikulčice-Kostelisko represents a burial site in the sub-castle area of Mikulčice castle. It thus represents a population, where a higher social status and thus better living conditions of the persons buried there may be presumed. Prušánky and Josefov are burial sites in the hinterland of the Mikulčice centre. The group from Josefov is considered to be a peasant population, i.e. the poorer section of the population. In the case of Prušánky, given the grave equipment, a peasant character of the population cannot be ruled out. Nonetheless, individuals with a richer grave inventory are also buried here.

As to the sensitivity of individual teeth to the development of caries, the upper and lower jaws differed from each other. While in the case of the upper jaw, the most frequently affected teeth were not only the second molars but also the canines and premolars, in the case of the mandible, the most carious teeth included the first and second

molars. Usually, canines or premolars are not completely destroyed during life, thus intra-vital loss involved most often the first (in the case of the lower jaw) or the second molars (in the case of the upper jaw). Overall, in all the localities studied, the mandible was more affected, significantly so in females at all burial sites and males at Kostelisko. Similar data has been reported by a number of researchers in the case of variously dated series from all over the world (Stloukal 1963; Caselitz 1998; Hillson 1996; Beňuš/Thurzo 2001).

The degree of caries frequency F-CE is more or less homogenous in both sexes, ranging in males from 68.8% to 79.9% and in females from 72.2% to 81.3%. Very similar data has been reported from other Slavic burial sites on the territory of Bohemia (e.g. Lahovice, Libice), Moravia (e.g. Rajhard, Pohansko) and Slovakia (Nitra-Pod Zoborom, Nitra-Lupka, Děvín-Za kostelem, Závada-Chriby, Pobedim-Hradiště) (Hanáková/Stloukal 1987; Hanáková/Staňa/Stloukal 1986; Bodoriková/Thurzo/Drozdová 2005; Thurzo et al 2002). I. Jarošová (2003) also analyzed the similar data of cariousness from many Bohemia, Moravia and Slovakia localities (some from 9th-10th century) in her comparative study.

In the case of all burial sites, females were affected insignificantly more often. This trend is also apparent in most of the other localities, but it is not the rule. We confirmed a slight increase in the number of affected individuals with age. This reached a significant difference in the case of females at all three burial sites.

From the aspect of caries intensity, I-CE, males appeared to represent a more homogenous group. The values acquired do not diverge from the data reported from other Slavic burial sites.

Overall, females were affected more often than males. Significant differences related to the proportion of intra-vital losses. A correlation between the degree of dentition involvement and age was shown, with a significant increase in the proportion of intra-vital loss in both sexes at all burial sites as well as in the proportion of caries in females at Kostelisko.

We also examined, whether there exist differences between socially differentiated groups, which were represented on the one hand by Kostelisko and on the other by Josefov and Pružánky, and whether such differences also exist within the individual burial sites between rich and poor graves. Although the interpretation is not unequivocal, different eating habits that can also influence the development of dental caries may be presumed in the different population classes.

Specialised literature does not provide much information regarding the diet of old Slavs. There is no doubt, though, that this diet was based on the products of agricultural crops. The main food was wheat and rye bread. Millet pudding and oatmeal were also a frequent meal. Honey or dried fruit were used for sweetening. Milk and dairy products as well as the meat of domestic animals were an equivalent component of diet. As reported by Beranová (1988, 2005), "at first, the members of the higher social classes did not differ by the fact that they ate much more meat, but by the fact that they ate different meat and that they were partial to its more complex and demanding preparation". Also, game, poultry and rare fruit found their way more often to their table. Such a combination of starches and sugars is highly cariogenic. On the other hand, milk, dairy products, animal fats are associated with a lower incidence of caries (e.g. Costa 1980; Mundorff-Shreshsta et al 1994; Hillson 1996). A rougher diet may reduce the incidence of caries, softer food, on the other hand, supports caries formation (Hillson 2001).

Among the groups compared, we did not find any significant differences in the F-CE indicator. As to the individual components of caries intensity, I-CE, a statistically insignificant difference was found in the amount of caries uncovered, while the proportion of intra-vitally lost teeth was significantly lower in middle-aged and older males and females from Kostelisko. These findings show that socially differentiated population groups did not show a different propensity to the development of caries in the younger age categories, with significant differences appearing only with increasing age. The socio-economically

higher Kostelisko population was characterised by lower cariousness, compared with both rural populations. Similarly, lower cariousness was found in individuals from rich graves at all the studied burial sites. These differences may be associated not only with different diet, but also with different hygiene or with practices relating to the "maintenance" of carious teeth (e.g. pulling out of affected teeth). However, we do not have at our disposal information regarding the cultural behaviour of old Slavs that could influence the state of dentition. Beňuš/Thurzo (2001) compared the early Middle Age castle population of Děvín-Hrad with the Great Moravian peasant nobility from Děvín-Za kostelem. Contrary to our findings, these authors found an insignificant higher cariousness of dentition in the castle population, whom they expected to be of higher social status and thus their diet and food to be softer and richer in saccharides, while the peasants living beyond the stronghold walls lived on a rougher and thus less carious diet.

The data acquired represent the basis for a database for further research in the field of dental anthropology. Further research including the evaluation of caries position, abscesses, enamel hypoplasia, traumatic lesions of teeth and jaws or teeth abrasion is a prerequisite for acquiring basic information regarding the influence of ecological aspects on the state of dentition in Great Moravian populations.

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References

Beňuš/Thurzo 2001 – R. Beňuš/M. Thurzo, Porovnanie zdravotného stavu chrupu veľkomoravskej a ranostredovekej populácie z Bratislavy-Devína. Bull. Slov. Antropol. Spol. 4, 2001, 17–22.

Beranová 1988 – M. Beranová, Slované (Slavs) (Panorama, Praha 1988).

Beranová 2005 – M. Beranová, Jídlo a pití v pravěku a ve středověku (Academia, Praha 2005).

Bodoriková/Thurzo/Drozdová 2005 – S. Bodoriková/ M.Thurzo/E. Drozdová, Kazivosť zubov adolescentov a dospelých zo staroslovanského pohrebiska Pohansko – "Pohřebiště okolo kostela" pri Breclavi, Česká republika. Acta Rer. Natur. Mus. Nat. Slov. 51, 2005, 88–101.

Bodoriková/Drozdová 2005 – S. Bodoriková/ E. Drozdová, Kazivosť zubov v populácii detí zo staroslovanského pohrebiska Pohansko – „Pohřebiště okolo kostela", Česká republika. Slovenská Antropológia 8/1, 2005, 25–31.

Caselitz 1998 – P. Caselitz, Caries-ancient plague of humankind. In: K.W. Alt/F.W. Rösing/M. Teschler-Nicola (eds.), Dental Anthropology. Fundamentals, Limits and Prospects (Springer-Verlag, Wien 1998).

Costa 1980 – R.L. Costa, Incidence of caries and abscesses in archeological Eskimo skeletal samples from Point Hope and Kodiak Island, Alaska. Am. J. Phys. Anthropol. 59, 1980, 97–110.

Duyar/Erdal 2003 – I. Duyar/Y.S. Erdal, A new approach for calibrating dental caries frequency of skeletal remains. Homo 54/1, 2003, 57–70.

Hanáková/Staňa/Stloukal 1986 – H. Hanáková/ Č. Staňa/M. Stloukal, Velkomoravské pohřebiště v Rajhradě (Národní muzeum - Přírodovědecké muzeum, Praha 1986).

Hanáková/Stloukal 1966 – H. Hanáková/M. Stloukal, Staroslovanské pohřebiště v Josefově. Antropologický rozbor. Rozpravy Československé akademie věd, Řada společenských věd 76/9 (Academia, Praha 1966).

Hanáková/Stloukal 1987 – H. Hanáková/M. Stloukal, Health condition of the teeth in old Slavonic populations. Acta Musei Nationalis Pragae. B, Hist. Naturalis 43 (2-4) 1987, 196–202.

Hillson 1996 – S. Hillson, Dental Anthropology (University Press, Cambridge 1996).

Hillson 2001 – S. Hillson, Recording dental caries in archeological human remains. Int. J. Osteoarchaeol. 11, 2001, 249–289.

Hrubý 1955 – V. Hrubý, Staré Město, velkomoravské pohřebiště „"Na valách". Monumenta archaeologica III (Praha 1955).

Jarošová 2003 – I. Jarošová, Dental caries in skeletal population from Znojmo-Hradiště (in comparison with archeological human remains from the Czech and Slovak republic). Slovenská antropológia 6 (1), 2003, 57–60.

Kilian et al. 1999 – J. Kilian et al., Stomatologie pro studující všeobecného lékařství (Karolinum, Praha 1999).

Klanica 1977 – Z. Klanica, Kostrové hroby z 8.-9. století v Prušánkách (okr. Hodonín). Přehled výzkumů 1975, 1977, 53.

Klanica 1980 – Z. Klanica, Výzkum pohřebiště z 8.-9. stol. a pravěkých sídlištních objektů v Prušánkách v roce 1978 (okr. Hodonín). Přehled výzkumů 1978, 1980, 28.

Lucacs 1995 – J.R. Lucacs, The „caries correction factor": A new method of calibrating dental caries rates to compensate for antemortem loss of teeth. Int. J. Osteoarchaeol. 5, 1995, 151–156.

Mundorff-Shreshsta et al. 1994 – S.A. Mundorff-Shreshsta/J.D.B. Featherstone/ A.D. Eisenberg/ E. Cowles/M.E.J. Curzon/M.A. Espeland/C.P. Shields, Cariogenic potential of foods. II. Relationship of food composition, plaque microbial counts, and salivary parameters to caries in the rat model. Caries Res. 28, 1994, 106–115.

Poláček/Marek 1995 – L. Poláček/O. Marek, Die Grabungen in Mikulčice 1954-1992. Geschichte, Grabungsmethoden und Dokumentation. In: F. Daim/L. Poláček (Hrsg.), Studien zum Burgwall von Mikulčice I. Spisy AÚ AV ČR Brno 2 (Brno 1995) 13–82.

Saunders/De Vito/Katzenberg 1997 – S.R. Saunders/C. De Vito/M.A. Katzenberg, Dental caries in neineteenth century Upper Canada. Am. J. Phys. Anthropol. 104, 1997, 71–87.

Stloukal 1963 – M. Stloukal, Der Gesundheitszustand des Gebisses bei der Population von grossmärischen Mikulčice. Anthropologie 3, 1963, 35–45.

Stloukal 1970 – M. Stloukal, Anthropologische Unterschiede bei Gräbern verschiedener Ausstattung im Gräberfeld von Mikulčice. In: Sborník J.Poulíkovi k šedesátinám (Archeologický ústav ČSAV, Brno 1970) 121–127.

Stloukal/Vyhnánek 1976 – M. Stloukal/L. Vyhnánek, Slované z velkomoravských Mikulčic (Academia, Praha 1976).

Stránská et al. 2002 – P. Stránská/P. Velemínský/ J. Likovský/J. Velemínská, The great Moravian cemetery at Josefov. Basic anthropological characteristics, possible expression of physiological and physical loads, state of health. Čas. Nár. muz., ř. přírodovědná 182/1-4, 2002, 131–176.

Stránská/Likovský/Velemínská 2005 – P. Stránská/ J. Likovský/J. Velemínská, State of dental health and selected pathological conditions in the recent skulls from the Pachner´s collection. Slovenská Antropológia 8/2, 2005, 127–137.

Strouhal 1959 – E. Strouhal, Zdravotní stav chrupu pravěkého člověka z hlediska životních podmínek. (Filosofická fakulta UK, Praha 1959).

Šlaus 2000 – M. Šlaus, Biocultural analysis of sex differences in mortality profiles and stress levels in the late medieval population from Nova Rača, Croatia. Am. J. Phys. Anthropol. 111, 2000, 193–209.

Šlaus 2002 – M. Šlaus, The bioarchaeology of Continental Croatia. An analysis of human skeletal remains from the prehistoric to post-medieval periods. BAR International Series 1021 (Archaeopress, Oxford 2002).

Thurzo et al. 2002 – M. Thurzo/A. Šefčáková/ S. Katina/J. Jakab/R. Beňuš/S. Bodoriková, Dental disease as an indicator of ecological factors in medieval skeletal populations from Slovakia. In: P. Bennike/E.B. Bodzsár/C. Susanne, Ecological aspects of past human settlements in Europe (Eötvös University Press, Budapest 2002).

Trefný/Velemínský 2006 – P. Trefný/P. Velemínský, Linear Enamel Hypoplasias in Early Medieval Population of Great Moravia (Czech Republic). Am. J. Phys. Anthropol., 74th Annual Meeting Issue, Suppl. 40, 2006, 208.

Velemínský 2000 – P. Velemínský, Mikulčice-Kostelisko. Projevy nespecifické zátěže a možnosti stanovení pokrevní příbuznosti na základě morfologických znaků. PhD thesis, Faculty of Science, Charles University, Prague (Praha 2000).

Velemínský et al. 2005 – P. Velemínský/J. Likovský/ P. Trefný/M. Dobisíková/J. Velemínská/L. Poláček/ H. Hanáková, Großmährisches Gräberfeld auf „Kostelisko" im Suburbium des Mikulčicer Burgwalls. Demographie, Spuren nicht spezifischer Belastung physiologischen und physischen Charakters auf Skeletten, Gesundheitszustand. In: L. Poláček (Hrsg.), Studien zum Burgwall von Mikulčice VI. Spisy AÚ AV ČR Brno 23 (Brno 2005) 539–633.

Table 4. Dental caries and intravital loss in the individual teeth and jaws – Mikulčice-Kostelisko.

	Teeth	Male			Female			Male+Female		
		N	Caries	%	N	Caries	%	N	Caries	%
maxilla	I1	69	-	0,0	102	-	0,0	171	-	0,0
	I2	79	1	1,3	130	2	1,5	209	3	1,4
	C	107	1	0,9	149	4	2,7	256	5	1,9
	P1	114	5	4,4	152	10	6,6	266	15	5,6
	P2	118	8	6,8	163	5	3,1	281	13	4,6
	M1	109	6	5,5	157	8	5,1	266	14	5,3
	M2	91	4	4,4	154	14	9,1	245	18	7,3
	in total	687	25	3,6	1007	43	4,2	1694	68	4,0
mandible	I1	69	0	0,0	136	4	2,9	205	4	1,9
	I2	96	0	0,0	166	2	1,2	262	2	0,8
	C	117	1	0,9	181	2	1,1	298	3	1,0
	P1	108	0	0,0	178	8	4,5	286	8	2,8
	P2	96	5	5,2	163	9	5,5	259	14	5,4
	M1	85	9	10,6	117	18	15,4	202	27	13,4
	M2	108	13	12,0	141	18	12,7	249	31	12,4
	in total	679	28	4,1	1082	61	5,6	1761	89	5,0
	alveoli	Male			Female			Male+Female		
		N	Intrav. loss	%	N	Intrav. loss	%	N	Intrav. loss	%
maxilla	I1	134	3	4,0	210	9	4,3	344	12	4,1
	I2	131	6	7,9	208	14	6,7	339	20	5,6
	C	140	4	2,9	209	6	2,9	349	10	2,7
	P1	138	5	3,6	207	14	6,8	345	19	5,1
	P2	137	7	5,1	208	20	9,6	345	27	7,6
	M1	136	19	13,9	202	36	17,8	338	57	15,8
	M2	123	29	23,6	196	34	17,3	657	63	20,3
	in total	940	73	8,8	1440	119	8,3	2380	208	8,6
mandible	I1	129	8	6,2	239	20	8,4	368	28	7,6
	I2	133	4	3,0	240	8	3,3	373	12	3,2
	C	141	1	0,7	248	5	2,0	389	6	1,5
	P1	135	4	2,9	245	15	6,1	380	19	5,0
	P2	135	21	15,6	235	32	13,6	370	53	14,3
	M1	138	43	31,1	232	100	43,1	370	143	38,6
	M2	141	28	19,9	225	70	31,1	366	98	26,8
	in total	952	109	11,4	1664	250	15,0	2616	359	13,7

Table 5. Dental caries and intravital loss in the individual teeth and jaws – Prušánky.

	Teeth	Male			Female			Male+Female		
		N	Caries	%	N	Caries	%	N	Caries	%
maxilla	I1	37	-	0,0	65	1	1,5	102	1	1,0
	I2	39	-	0,0	59	-	0,0	98	-	0,0
	C	60	9	15,0	88	7	7,9	148	16	10,8
	P1	61	4	6,7	88	5	5,7	149	9	6,0
	P2	58	3	5,2	84	6	7,1	142	9	6,3
	M1	47	-	0,0	81	5	6,2	128	5	3,9
	M2	39	2	5,1	70	9	12,9	109	11	10,1
	in total	341	18	5,3	535	33	6,2	876	51	5,8
mandible	I1	43	-	0,0	64	-	0,0	107	-	0,0
	I2	54	-	0,0	80	-	0,0	134	-	0,0
	C	67	-	0,0	109	1	0,9	176	1	0,6
	P1	65	1	1,5	104	2	1,9	169	3	1,8
	P2	61	4	6,6	90	6	6,7	151	10	6,6
	M1	37	5	13,5	58	8	13,8	95	13	13,7
	M2	43	3	6,9	68	7	10,3	111	10	9,0
	in total	370	13	3,5	573	24	4,2	943	37	3,9
	alveoli	Male			Female			Male+Female		
		N	Intrav. loss	%	N	Intrav. loss	%	N	Intrav. loss	%
maxilla	I1	75	3	4,0	135	20	14,8	210	23	10,9
	I2	76	6	7,9	135	21	15,6	211	27	12,8
	C	82	1	1,2	135	22	16,3	217	23	10,6
	P1	82	6	7,3	136	30	22,1	218	36	16,5
	P2	78	8	10,3	128	26	20,3	206	34	16,5
	M1	75	23	30,7	119	30	25,2	194	53	27,3
	M2	69	27	39,1	115	36	31,3	184	63	34,2
	in total	537	74	13,8	903	185	20,5	1440	259	17,9
mandible	I1	74	2	2,7	139	30	21,6	213	32	15,0
	I2	75	0	0,0	138	24	17,4	213	24	11,3
	C	76	0	0,0	142	14	9,9	218	14	6,4
	P1	76	1	1,3	139	17	12,2	215	18	8,4
	P2	76	9	11,8	138	30	21,7	214	39	18,2
	M1	76	38	50,0	136	71	52,2	212	109	51,4
	M2	75	30	40,0	129	58	44,9	204	88	43,1
	in total	528	80	15,2	961	244	25,4	1489	324	21,8

Table 6. Dental caries and intravital loss in the individual teeth and jaws – Josefov.

	Teeth	Male			Female			Male+Female		
		N	Caries	%	N	Caries	%	N	Caries	%
maxilla	I1	19	1	5,3	22	-	-	41	1	2,4
	I2	14	-	0,0	30	-	-	44	-	0,0
	C	17	-	0,0	27	1	3,7	43	1	2,3
	P1	18	2	11,1	34	3	8,8	52	5	9,6
	P2	22	3	13,6	35	1	2,9	57	4	7,0
	M1	18	2	11,1	34	2	5,9	52	4	7,7
	M2	11	1	9,1	28	1	3,6	39	2	5,1
	in total	119	9	7,6	210	8	3,8	329	17	5,2
mandible	I1	14	-	0,0	31	-	0,0	45	-	0,0
	I2	16	-	0,0	33	-	0,0	49	-	0,0
	C	22	-	0,0	34	-	0,0	56	-	0,0
	P1	18	-	0,0	29	-	0,0	47	-	0,0
	P2	16	-	0,0	29	1	3,4	45	1	2,2
	M1	11	1	9,1	21	5	23,8	32	6	18,8
	M2	13	2	15,4	24	3	12,5	37	5	13,5
	in total	110	3	2,7	201	9	4,5	311	12	3,9
	alveoli	Male			Female			Male+Female		
		N	Intrav. loss	%	N	Intrav. loss	%	N	Intrav. loss	%
maxilla	I1	27	-	0,0	49	3	6,1	76	3	3,9
	I2	26	-	0,0	46	2	4,3	72	2	2,8
	C	27	-	0,0	48	2	4,2	75	2	2,7
	P1	27	5	18,5	48	6	12,5	75	11	14,7
	P2	28	2	7,1	48	4	8,3	76	6	7,9
	M1	25	5	20,0	46	9	19,6	71	14	19,7
	M2	25	11	44,0	44	11	25,0	69	22	31,9
	in total	185	23	12,4	329	37	11,2	514	60	11,7
mandible	I1	21	-	0,0	56	4	7,1	77	4	5,2
	I2	20	-	0,0	58	2	3,4	78	2	2,6
	C	26	-	0,0	56	4	7,1	82	4	4,9
	P1	22	1	4,5	54	5	9,3	76	6	7,9
	P2	22	2	9,1	55	14	25,5	77	16	20,8
	M1	22	11	50,0	56	32	57,1	78	43	55,1
	M2	23	10	43,5	55	24	43,6	78	34	43,6
	in total	156	24	15,4	390	85	21,8	546	109	20,0

Table 7. F-CE – Mikulčice-Kostelisko. Frequency of caries.

Sex	Age	N	Caries (c.)		Intrav. loss		c.+i.l.		F-CE
			n	%	n	%	n	%	
males	20-35	25	5	20,0	4	16,0	5	20,0	56,0
	35-50	41	5	12,2	11	26,8	16	39,0	38,9
	over 50 years	13	-	-	4	30,8	7	53,8	84,6
	in total	79	10	12,7	19	24,1	28	35,4	72,2
females	20-35	62	14	22,6	12	19,4	13	20,9	62,9
	35-50	55	6	10,9	27	49,1	16	29,1	89,1
	over 50 years	12	-	-	6	50,0	6	50,0	100,0
	in total	129	20	15,5	45	34,9	35	27,1	77,5
m+f	20-35	87	19	21,8	16	18,4	18	20,7	60,9
	35-50	96	11	11,5	38	39,6	32	33,3	84,4
	over 50 years	25	-	-	10	40,0	13	52,0	92,0
	in total	208	30	14,4	64	30,8	63	30,3	75,5

Table 8. F-CE – Prušánky. Frequency of caries.

sex	Age	N	Caries (c.)		Intrav. loss		c.+i.l.		F-CE
			n	%	n	%	n	%	
males	20-35	5	1	20,0	1	20,0	1	20,0	60,0
	35-50	26	1	3,8	12	46,2	9	34,6	84,6
	over 50 years	14	-	-	6	42,8	5	35,7	78,5
	in total	45	2	4,4	19	42,2	15	33,3	79,9
females	20-35	20	4	20,0	4	2,0	3	15,0	55,0
	35-50	37	1	2,7	13	35,1	17	45,9	83,7
	over 50 years	19	-	-	12	63,2	6	31,6	94,8
	in total	76	5	8,2	29	38,2	26	34,2	80,6
m+f	20-35	25	5	20,0	5	20,0	4	16,0	56,0
	35-50	63	2	3,2	25	39,7	26	41,3	90,5
	over 50 years	33	-	-	18	54,5	11	33,3	87,8
	in total	121	7	5,8	48	39,7	41	33,9	79,4

Table 9. F-CE – Josefov.

Sex	Age	N	Caries (c.)		Intrav. loss		c.+i.l.		F-CE
			n	%	n	%	n	%	
male	20-35	2	-	-	1	50,0	-	-	50,0
	35-50	7	-	-	-	-	3	42,9	42,9
	over 50 years	7	-	-	2	28,6	5	71,4	100,0
	in total	16	-	-	3	12,5	8	50,0	68,8
female	20-35	5	2	40,0	-	-	1	20,0	60,0
	35-50	12	1	8,3	2	16,7	5	41,7	66,7
	over 50 years	15	1	6,7	9	60,0	5	33,3	100,0
	in total in total	32	4	12, 5	11	34,4	11	34,4	81,3
m+f	20-35	7	2	28,6	1	14,3	1	14,3	57,2
	35-50	19	1	5,3	2	10,5	8	42,1	57,9
	over 50 years	22	1	4,5	11	50,0	10	45,5	100,0
	in total	48	4	8,3	14	29,2	19	31,7	69,2

Table 10. I-CE – Mikulčice-Kostelisko.

Sex	Age	Preserved	N	c.+i.l.	%	I-CE
male	20-35	teeth	438	17	3,9	7,2
		alveoli	582	19	3,3	
	35-50	teeth	748	29	3,9	13,2
		alveoli	992	92	9,3	
	over 50 years	teeth	180	7	3,9	26,2
		alveoli	318	71	22,3	
	in total	teeth	1366	53	3,9	14,1
		alveoli	1892	182	10,2	
female	20-35	teeth	1168	42	3,6	8,1
		alveoli	1480	66	4,5	
	35-50	teeth	789	43	5,4	22,5
		alveoli	1330	227	17,1	
	over 50 years	teeth	132	19	14,4	45,0
		alveoli	294	90	30,6	
	in total	teeth	2089	104	5,0	16,9
		alveoli	3104	383	11,9	
m+f	20-35	teeth	1606	59	3,7	7,8
		alveoli	2062	85	4,1	
	35-50	teeth	1537	72	4,7	18,4
		alveoli	2322	319	13,7	
	over 50 years	teeth	312	26	8,3	34,6
		alveoli	612	161	26,3	
	in total	teeth	3455	157	4,5	15,8
		alveoli	4996	565	11,3	

Table 11. I-CE – Prušánky.

Sex	Age	Preserved	N	c.+i.l.	%	I-CE
male	20-35	teeth	124	5	3,6	5,8
		alveoli	135	3	2,2	
	35-50	teeth	354	15	4,2	20,5
		alveoli	581	95	16,3	
	over 50 years	teeth	233	11	4,7	20,7
		alveoli	349	56	16,0	
	in total	teeth	711	31	4,3	18,8
		alveoli	1065	154	14,5	
female	20-35	teeth	395	16	4,1	8,5
		alveoli	475	21	4,4	
	35-50	teeth	544	26	4,8	24,5
		alveoli	927	183	19,7	
	over 50 years	teeth	169	15	8,9	55,8
		alveoli	462	225	46,9	
	in total	teeth	1108	57	5,1	28,1
		alveoli	1864	429	23,0	
m+f	20-35	teeth	519	21	4,0	7,9
		alveoli	610	24	3,9	
	35-50	teeth	898	41	4,6	23,0
		alveoli	1508	278	18,4	
	over 50 years	teeth	402	26	6,5	41,1
		alveoli	811	281	34,6	
	in total	teeth	1819	88	4,8	24,7
		alveoli	2929	583	19,9	

Table 12. I-CE – Josefov.

Sex	Age	Preserved	N	c.+i.l.	%	I-CE
male	20-35	teeth	48	-	-	1,8
		alveoli	56	1	1,8	
	35-50	teeth	94	4	4,3	10,3
		alveoli	116	7	6,0	
	over 50 years	teeth	87	8	9,2	32,9
		alveoli	169	40	23,7	
	in total	teeth	229	12	5,2	19,3
		alveoli	341	48	14,1	
female	20-35	teeth	99	4	4,0	5,7
		alveoli	116	2	1,7	
	35-50	teeth	165	5	3,0	13,0
		alveoli	268	27	10,0	
	over 50 years	teeth	147	8	5,4	33,2
		alveoli	335	93	27,8	
	in total	teeth	411	17	4,1	20,8
		alveoli	719	122	16,7	
m+f	20-35	teeth	147	4	2,7	3,9
		alveoli	172	2	1,2	
	35-50	teeth	259	9	3,5	12,4
		alveoli	384	34	8,9	
	over 50 years	teeth	234	16	6,8	33,2
		alveoli	504	133	26,4	
	in total	teeth	640	29	4,5	20,4
		alveoli	1060	169	15,9	

Table 13. I-CE in rich and poor graves – Mikulčice-Kostelisko.

		Preserved	N	c.+i.l.	%	I-CE
male	rich g.	teeth	552	16	2,9	8,8
		alveoli	687	41	5,9	
	poor g.	teeth	814	37	4,5	16,2
		alveoli	1205	141	11,7	
female	rich g.	teeth	686	42	6,1	15,5
		alveoli	915	86	9,4	
	poor g.	teeth	1403	62	4,4	18,0
		alveoli	2189	297	13,6	
m+f	rich g.	teeth	1238	58	4,7	12,6
		alveoli	1602	127	7,9	
	poor g.	teeth	2217	99	4,5	17,4
		alveoli	3394	438	12,9	

Table 14. I-CE in rich and poor graves – Prušánky.

		Preserved	N	c.+ i.l.	%	I-CE
male	rich g.	teeth	101	2	1,9	10,4
		alveoli	142	12	8,5	
	poor g.	teeth	610	29	4,7	20,1
		alveoli	923	142	15,4	
female	rich g.	teeth	442	30	6,8	25,0
		alveoli	660	120	18,2	
	poor g.	teeth	666	27	4,1	29,8
		alveoli	1202	309	25,7	
m+f	rich g.	teeth	543	35	5,9	22,4
		alveoli	802	132	16,5	
	poor g.	teeth	1276	56	4,4	25,6
		alveoli	2125	451	21,2	

Table 15. I-CE in rich and poor graves – Josefov.

		Preserved	N	c.+ i.l.	%	I-CE
male	rich g.	teeth	63	1	1,6	9,0
		alveoli	81	6	7,4	
	poor g.	teeth	166	11	6,6	22,8
		alveoli	260	42	16,2	
female	rich g.	teeth	170	5	2,9	15,9
		alveoli	261	34	13,0	
	poor g.	teeth	241	12	5,0	24,2
		alveoli	458	88	19,2	
m+f	rich g.	teeth	233	6	2,6	14,3
		alveoli	342	40	11,7	
	poor g.	teeth	407	23	5,7	23,8
		alveoli	718	130	18,1	