ODONTOPATHIES IN THE POPULATION OF OLD IAŞI CITY (ROMANIA): THE NECROPOLIS OF THE “BANU” CHURCH, 16TH-19TH CENTURIES

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Abstract. This study describes the incidence and the analysis of a series of odontopathies observed in a skeletal series dating from the 16th-19th centuries, found in the necropolis of the ancient “Banu” Church of Iaşi City (Romania). The unearthed material is mostly derived from reinhumation tombs and includes 67 skeletons, out of which 18 children, three adolescents 2 adults, 40 mature and 4 senile. The distribution by gender indicates a higher male mortality rate (29 men as opposed to 20 women). Among the odontopathies observed in the 67 subjects, dental caries, radicular remains, supragingival dental calculus and edentia have equal incidence – 5.97%, whereas microdontia recorded 1.49%.

Keywords: Iaşi City, necropolis, 16th-19th centuries, “Banu” Church, odontopathies

Rezumat. Odontopatii la populaţia vechiului oraş Iaşi (România): necropola Bisericii „Banu”, secolele XVI-XIX. În studiul de faţă autorii prezintă incidenţa şi analiza unor odontopatii semnalate la o serie osteologică care datează din secolele XVI-XIX, deshumată din necropola vechii Biserici „Banu” din Iaşi. Materialul deshumat, provenit în mare parte din morminte cu reînhumări, este reprezentat prin 67 de schelete, dintre care 18 aparţin copiilor, trei adolescenţilor, două adulţilor, 40 maturilor şi patru senililor. Repartiţia pe sexe, indică o rată de mortalitate mai ridicată a bărbaţilor faţă de femei (29 bărbaţi faţă de 20 de femei). Dintre odontopatiile semnalate la cei 67 de subiecţi, cariile dentare, resturile radiculare, calculusul dentar supragingival şi edentaţia prezintă procente egale – 5,97%, iar microdonţia înregistrează un procent de 1,49%.

Cuvinte cheie: oraşul Iaşi, Biserica Banu, necropolă, secolele XVI-XIX, odontopatii

Introduction

Dental remains, the hardest and most chemically stable tissues in the organism (Roberts & Manchester, 2005), provide valuable information about a population’s state of health and nutrition (Turner 1979; Lukacs, 1992). In an anthropological study, having knowledge about the tooth disorders, as well as the dental pathology in general, has great significance in establishing a connection between these disorders and the culture of the age.

Dental paleopathology identifies and explains tooth and jaw anomalies in the past populations. The analysis of the dental pathologies and anomalies is based on two research traditions. The first one refers to the relation between tooth diseases and cultural factors, such as nutrition and subsistence diet, whereas the second targets developmental dental anomalies, which are more significantly influenced by genetic factors.

Ethnographic documentation and information concerning diet and food preparation are requisite in order to better understand the incidence of the various tooth pathologies (Lukacs, 2012). The use of teeth as instruments in a wide area of activities non-related to diet is improved and amplified by ethnographic research (Larsen, 1985; Brown & Molnar, 1990).

Infectious diseases, such as caries, are some of the most common affections observed in archeological populations, whereas the jaw degenerative diseases include ante-mortem tooth loss, usually in elders. Development problems include enamel hypoplasia and genetic anomalies (Roberts & Manchester, 2005). We remarked that tooth disorders don't develop separately, but there is a complex relation between them (Lukacs, 1989).

Archeological excavations conducted in 2011 by the Centre for European History and Civilization, Iasi Branch of the Romanian Academy, under the guidance of C.S. I archaeologist PhD Mrs. Stela Cheptea, on the premises of the current "Banu" Church of Iași City (Romania), brought to light a part of the necropolis of the ancient church, dating from 1705 (Bogdan, 1997-2004). The authors of the diggings indicate that the necropolis was used between the first half of the 16th century and the beginning of the 19th century.

This study intends to analyze the prevalence and characteristics of specific odontopathies (dental caries, radicular remains, dental calculus/scale, edentia and microdontia) observed in the osteological series exhumed from the necropolis located on the premises of the "Banu" Church of Iași City.

Material and Methods

The osteological material consists of 67 skeletons (children, teenagers, adults, mature and senile) coming from both numbered tombs (individual for the most part – skeletons noted with "M"), but mostly from reinhumation tombs (skeletons noted with "R"). Of the total of 67 skeletons, 46 belonged to adults, 18 to children and only three belonged to teenagers. The precarious state of preservation, as well as the skeleton deterioration during excavations, impeded us to abide strictly by the analysis stages.

The study of the osteological material was preceded by a process marking and restoration of the main segments of each skeleton using the available fragments, as well as a process of filling up the missing sections with a moldable mass. This allowed us to proceed afterwards to the bio-morphoscopic analysis in order to determine each subject's age and gender.

So as to establish the gender and age at the time of death for the subjects over 18 years, we used the methods, criteria and techniques recommended by Ferembach *et al.,* (1979), Ubelaker (1979), Brothwell (1981), Buikstra & Ubelaker (1994), Bruzek (2002), Walrath *et al.,* (2004) and Schmitt (2005).

As concerns the subadults, the age at death was determined based on the primary teeth eruption, the permanent teeth eruption, the dental buds stages of development, the epiphyses fusion with the respective dyaphises and the fusion of the epiphyseal discs with the vertebrae. For the subjects under 20 years (*infans I, infans II* and *juvenis*), the age at death was established according to the methodology suggested by Maresh (1955, 1970), Moorrees *et al.,* (1963), Trotter & Peterson (1969), Fazekas & Kosa (1978), Ubelaker (1979), Jeanty (1983) and Schaefer *et al.,* (2009).

Since teeth are considered human remains which are very well preserved over time, they can provide information about the health state or the lifestyle of a past population. In this study we confined ourselves to macroscopic observations.

In order to identify dental pathologies, we cleaned the teeth (found in the alveoli or lost post mortem) using a soft brush, to eliminate the particles that would have impeded visual inspection. Caries (when perforations affected the dentin) were recorded based on their position and gravity. We identified the cases of edentia (partial or total absence of

teeth in the oral cavity due to falling after eruption caused by several factors) (Ionescu, 2005). We also observed the presence of radicular remains in the upper and lower jaw. We identified dental calculus or scale (grey-white mineralized plaque composed primarily of calcium phosphate), firmly attached to the dental surface. Depending on the positioning on the tooth crowns or exposed roots, dental calculus can be supragingival or subgingival (Waldron, 2009).

A tooth anomaly observed in this population was microdontia, a condition in which one or several teeth appear smaller than normal (for example, short and narrow roots and crowns) (Lyngstadaas *et al.*, 1996).

Results and Discussion

Considering the total 67 skeletons subjected to study, we are first and foremost struck by the relatively high child mortality rate (0-14 years: 26.87%), which shows that approximately a quarter of the population died before reaching adolescence. If we add to this the teen mortality rate (14-18 years: 4.48%), we observe that more than one third of the subjects (31.35%) didn't reach adulthood. The highest mortality rate is associated with the age interval 0-7 years (17.91%), whereof half of the skeletons belonged to the interval 0-1 years (6 out of 12 children). Among the population that reached at least adulthood, (20-x years: approximately 68.66%), 59.70% of the subjects died in full maturity (32.84% males and 26.87% females) and a were 5.97% (4.48% males and 1.49 females) reached the old age (60-x years); only 2 deaths were recorded in the adult stage (2.99%, both of them males).

The analysis of mortality by gender revealed a higher male mortality rate (29 men as opposed to 20 women, with a masculinity index of 1.45). This disparity was observed in all the age groups (juvenile, adult, mature and senile).

The presence of odontopathies in the osteological series discovered on the premises of the "Banu" Church of Iaşi (16^{th}-19^{th} centuries) is rendered in Table 1. The incidence was calculated for the two genders (29 men and 20 women), as well as for the entire lot of subjects (67). Among the odontopathies observed, edentia, dental caries, dental calculus and radicular remains had equal incidence – 5.97%, whereas microdontia had the lowest incidence at 1.49% (Table 1).

Table 1. Incidence of odontopathies in the osteological series exhumed from the necropolis of the "Banu" Church of Iaşi (16^{th}-19^{th} centuries).

Odontopathies	Men (14-x years)		Women (14-x years)		Children (0-14 years)		Total	
	N	(%)	N	(%)	N	(%)	N	(%)
Dental caries	3/29	10.34	1/20	5	-	-	4/67	5.97
Radicular remains	3/29	10.34	1/20	5	-	-	4/67	5.97
Dental calculus/scale	3/29	10.34	1/20	5	-	-	4/67	5.97
Edentia	3/29	10.34	1/20	5	-	-	4/67	5.97
Microdontia	1/29	3.44	-	-	-	-	1/67	1.49

Dental caries has a multifactor etiology, presenting various degrees of gravity, from opaque stains to large cavities affecting the teeth (Roberts & Manchester, 1995). The spreading of this disease in historical populations is undoubtedly associated with a carbohydrate-rich diet (Cucina *et al.*, 2011). This suggests that carbohydrate-rich foods are associated with a wider spreading of dental caries, the latter leading to physiological

changes of the oral cavity and changes of the bacterial flora in the oral cavity. Consequently, bioarchaeological studies use the incidence of dental caries as a nonspecific indicator of the eating behavior (Temple, 2011).

Powell (1985) indicates that the main factors influencing dental caries are: environmental factors (oligoelements present in food and water), pathogenic agents (bacteria causing the disease), exogenous factors (diet, oral hygiene) and endogenous factors (teeth shape and structure).

As regards the incidence of dental caries, some researchers noticed that it is much higher in female subjects as opposed to male subjects (Fujita *et al.*, 2007; Temple & Larsen, 2007), due to the fact that men eat bigger amounts of non-cariogenic foods, whereas women eat larger quantities of cariogenic carbohydrates (Temple, 2011). There are authors who suggest that people belonging to a higher social class have access more easily to cariogenic foods, including exotic products containing high levels of sucrose (Cucina & Tiesler, 2003). Alternatively, there is the belief that the upper class can afford to eat more meat proteins, which would consequently lead to less caries (Larsen, 1997). As a specific trait of the ancient populations we studied, mandibular teeth – mainly lateral teeth – are generally less resistant than maxillary teeth.

In the studied series, dental caries was observed in four subjects, more specifically three men aged between 22 and 50 (Figs. 1-3) and one women aged 35-40 years (Fig. 4). In three of the cases, dental caries affected the mandibular first molars, whereas in one case it affected the mandibular second molars.

Figure 1. Mandible, occlusal caries, gr. III-IV (left and right second molar) (R 2, ♂, 22-25 years).

Figure 2. Mandible, approximal caries, gr. II (right first molar) (M 36, ♂, 40 years).

Figure 3. Mandible, occluso-approximal caries, gr. II (left first molar) (M 28, ♂, 45-50 years).

Figure 4. Mandible, occlusal caries, gr. II (left first molar) (R 18, ♀, 35-40 years).

Radicular remains. Dental abrasion can be induced both by the use of teeth in the mastication process (which leads to the wearing of the contact surface, due to the disappearance of the tough substance from the teeth) and by tooth pathology (Ştefănescu, 2007). Five degrees of dental abrasion established by Périer are used to highlight the disappearance of the enamel form the dentin (Chira, 1981). The fifth degree is represented by pronounced abrasion, leading to the disappearance of the crown, which makes visible the pulp chamber. This is how *radicular remains* result.

Radicular remains were identified in three male subjects (aged between 22 and 65, Figs. 5-7) and one female subject (40-45 years), affecting the mandibular and maxillary teeth (Fig. 8).

Figure 5. Upper jaw, radicular remain (second premolar and first molar on the left). (R 2, ♂, 22-25 years).

Figure 6. Mandibular fragment, radicular remain (right first molar) (R 8, ♂, 35-40 years).

Figure 7. Upper jaw fragment, radicular remain (right first premolar) (R 15(A), ♂, 60-65 years).

Figure 8. Upper jaw fragment, radicular remain (left second premolar) (R 16(B), ♀, 40-45 years).

Dental calculus/scale. Dental calculus (scale) appears in the form of a mineralized plaque composed primarily of calcium phosphate. Depending on its localization, either on

the tooth crown or the exposed roots, there are two forms of calculus: supragingival and subgingival (Waldron, 2009).

According to Waldron (2009), there is an inverse relationship between calculus and caries, since calculus needs an alkaline environment to develop, whereas caries develop in an acidic environment, which leads to the logical conclusion that the two processes are incompatible. Dental calculus appears most frequently on the teeth located closest to the salivary glands (especially mandibular incisors and maxillary molars) (Roberts & Manchester, 2005).

In the analyzed osteological series, supragingival dental calculus was identified in five cases, more specifically four men aged between 18 and 50 (Figs. 9-11) and a mature woman (35-40 years) (Fig. 12).

Figure 9. Mandible fragment, supragingival dental calculus (C, P1, P2, M1 – right hemiarcade) (R 3, ♂, 45-50 years).

Figure 10. Mandible, supragingival dental calculus (I1, I2, C – right hemiarcade; I2, C, P1 – left hemiarcade) (R 5, ♂, 18-20 years).

Figure 11. Mandible, supragingival dental calculus (C – left hemiarcade) (R 2, ♂, 22-25 years).

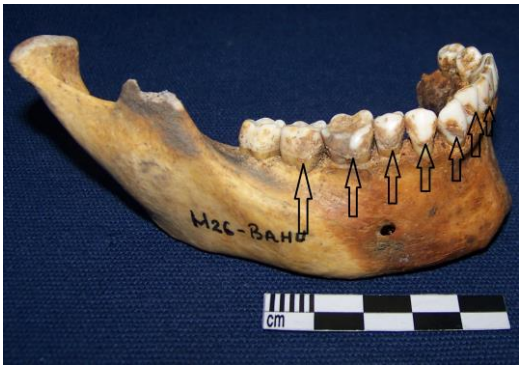

Figure 12. Mandible fragment, supragingival dental calculus (I1, I2, C, P1, P2, M1, M2 – right hemiarcade) (M 26 (B), ♀, 35-40 years).

Edentia refers to the partial or total absence of teeth in the oral cavity, caused by their falling after eruption due to several factors. The main cause for edentia is dental caries

and its complications. There are also other disorders, such as infections of the soft tissues or bone tissues (osteomyelitis), tumors or facial traumas which can lead to edentia (Ionescu, 2005). Edentia can be: frontal (missing incisors and canines, with interlaced spaces), lateral (missing premolars and molars, where the spaces can be unilateral or bilateral), terminal (uniterminal or biterminal, located exclusively anteriorly), mixed (interlaced and terminal spaces), subtotal (with 1-2 remaining teeth), or complete including both the upper and the lower jaw (Ştefănescu, 2007).

A secondary effect of edentia is the remodeling of the affected portion of facial skeleton, defined by the bone mass reduction through resorption and atrophy; this causes the lower side of the face to fall, due to the upper jaw and mandible decrease in height and the reduction of the mandibular thickness (Firu, 1967).

Edentia was identified in three male subjects aged between 50 and 65 (Figs. 13-15) and a female subject aged 60-65 years (Fig. 16). Edentia is total in all cases, which is the most frequently encountered form after the age of 50.

Figure 13. Mandible, edentia (R 15 (A), ♂, 60-65 years).

Figure 14. Mandible fragment, edentia (R 15 (B), ♂, 50-55 years).

Figure 15. Incomplete mandible, edentia (M 43, ♂, 60-65 years).

Figure 16. Mandible, edentia (M 32, ♀, 60-65 years).

Microdontia is a tooth anomaly defined by the appearance of one ore several teeth with smaller dimensions than normal (for example: short and narrow roots and crowns).

This anomaly can affect a single tooth or can be partially or fully generalized, which is rarely encountered in specialized literature. Microdontia can frequently appear in association with hypodontia. Microdontia involving a single tooth is quite common. The most frequently affected teeth are maxillary lateral incisors and third molars (Lyngstadaas *et al.*, 1996).

Microdontia is an inherited developmental anomaly, with dominant traits, handed down through crisscrossed inheritance, which means that the micro-dimensioned teeth are inherited from one parent, whereas the over-dimensioned teeth are inherited from the other parent. The incidence of microdontia in a population records values between 1% and 8%. It can appear as the result of a normal eruption or it can be caused by specific genetic disorders, case in which all teeth are micro-dimensioned (Down syndrome or hypophyseal nanism) (Lyngstadaas *et al.*, 1996).

In the series we studied, microdontia was identified in the upper jaw (third molar on the right hemiarcade) belonging to a male aged 18-20 (Fig. 17).

Figure 17. Upper jaw, microdontia (third molar, right hemiarcade) (R 5, ♂, 18-20 years).

Conclusions

The 67 human skeletons analyzed in this study were discovered in the necropolis exhumed in 2011 on the premises of the "Banu" Church of Iași City. The authors of the excavations date the necropolis between the first half of the 16th century and the beginning of the 19th century. The 67 skeletons belong to 18 children (0-14 years: 26.15%), three teenagers (2 ♂ and 1 ♀: 4.48%), two adults (2 ♂: 2.99%), 40 mature (22 ♂ and 18 ♀: 59.70%) and four senile (3 ♂ and 1 ♀: 5.97%). It is well known that during the Middle Ages there were many highly cariogenic foods which favored the disappearance of the thin enamel coating, leaving the dentin exposed. We also need to consider that the absence of some oligoelements or certain amino acids that are essential in teeth development can decrease teeth resistance, increasing their vulnerability to cariogenic agents. The odontopathies observed in this series mainly affect the male gender; thus, we identified dental caries, radicular remains, supragingival dental calculus and edentia (with equal incidence – 5.97%). As regards dental anomalies, we observed microdontia (defined by the

appearance of one ore several teeth with smaller dimensions than normal) in a single male subject (1.49%).

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References

Bogdan, N.A., 1997-2004. *Oraşul Iaşi – Monografie istorică şi socială ilustrată* (ediţia a III-a). Editura Tehnopress, Iaşi, 228-229.

Brothwell, D.R., 1981. *Digging up Bones*. Cornell University Press, London.

Brown, T., Molnar, S., 1990. Interproximal Grooving, and Task Activity in Australia. *American Journal of Physical Anthropology*, **81**: 545-554.

Bruzek, J., 2002. A method for visual determination of sex, using the human hip bone. *American Journal of Physical Anthropology*, **117**: 157-168.

Buikstra, J.E., Ubelaker, D.H., 1994. *Standards for Data Collection from Human Skeletal Remains*. Arkansas Archaeological Survey Research Series No 44, Fayetteville.

Chira, I., 1981. *Morfopatologia funcţională a aparatului dento-maxilar*. Editura Didactică şi Pedagogică, Bucureşti, 160-161.

Cucina, A., Tiesler, V., 2003. Dental caries and ante-marten1 tooth loss in the Northern Peten area, Mexico: a biocultural perspective on social status differences among the Classic Maya. *American Journal of Physical Anthropology*, **122**: 1-10.

Cucina, A., Cantillo, C.P., Sosa, T.S., Tiesler, V., 2011. Carious Lesions and Maize Consumption among the Prehispanic Maya: An Analysis of a Coastal Community in Northern Yucatan. *American Journal of Physical Anthropology*, **145** (4): 560-567.

Fazekas, I.Gy., Kosa, F., 1978. *Forensic Fetal Osteology*. Budapest Akademiai Kiado.

Ferembach, D., Schwidetzky, I., Stloukal, M., 1979. Recommandations pour determiner l’age et le sexe sur le squelette. *Bulletins et Memoires de la Societe d’Anthropologie de Paris*, **XIII**, 6, 1: 7-45.

Firu, P., 1967. *Stomatologia infantilă*. Ed. Pedagogică, Bucureşti.

Fujita, H., Asakura, K., Ogura, M., 2007. Age-and sex-related dental caries prevalence in Japanese from the Jomon period. *Journal of Oral Biosciences*, **49**: 198-204.

Ionescu, E., 2005. *Anomaliile dentare*, Cartea Universitară, Bucureşti.

Jeanty, P., 1983. Fetal limb biometry. *Radiology*, **147**: 601-602.

Larsen, C. S., 1985. Dental Modification and Tool Use in the Western Great Basin. *American Journal of Physical Anthropology*, **67**(4): 393-402.

Larsen, C.S. 1997. *Bioarchaeology: interpreting behavior from the human skeleton*. Cambridge, Cambridge University Press, 76-77.

Lingstadaas, S.P., Nordbo, H., Gedde-Dahl, T., Thrane, P.S., 1996. On the genetics of hypodontia and microdontia: synergism or allelism of major genes in a family with six affected members. *Journal of Medical Genetics*, **33**: 137-142.

Lukacs, J.R., 1989. Dental paleopathology: methods for reconstructing dietary patterns. In: Iscan M.Y. and Kennedy K.A.R. (Eds): *Reconstruction of life from the skeleton*. New York, Alan Liss, 261-286.

Lukacs, J.R., 1992. Dental Paleopathology and Agricultural Intensification in South Asia: New Evidence from Bronze Age Harappa. *American Journal of Physical Anthropology*, **87** (2): 133-150.

Lukacs, J.R., 2012. Oral Health in Past Populations: Context, Concepts and Controversies. In: Grauer A.L., (Ed.): *A Companion to Paleopathology*, First Edition, Blackwell Publishing Ltd., Oxford, United Kingdom, 553-581.

Maresh, M.M., 1955. Linear growth of long bones of extremities from infancy through adolescence. *American Journal of Diseases of Children*, **89**: 725-742.

Maresh, M.M., 1970. Measurements from roentgenograms. In: McCammon, R.W. (Ed.), *Human Growth and Development*, Springfield, IL: C.C.Thomas.

Moorrees, C.F.A., Fanning, E.A., Hunt, E.E., 1963. Age variation of formation stages for ten permanent teeth. *Journal of Dental Research*, **42**: 1490-1502.

Piperno, D., 1988. *Phytolith analysis: archaeological and geological perspective*. London, Academic Press.

Powell, M.L. 1985. The analysis of dental wear and caries for dietary reconstruction. In: Gilbert R.I. and Mielke J.H. (Eds.): *Analysis of prehistoric diets*. Academic Press, London, 307-338.

Roberts Ch., Manchester, K., 1995. *The Archaeology of Disease*. Cornell Publishing Limited, Cornell University Press, Ithaca, New York, 45-47.

Roberts Ch., Manchester, K., 2005. *The Archaeology of Disease*. Third Edition, Sutton Publishing Limited, United Kingdom, 63-84.

Schaefer, M., Black, S., Scheuer, L., 2009. *Juvenile osteology*, Elsevier Academic Press.

Schmitt, A., 2005. Une nouvelle methode pour estimer l'age au deces des adultes a partir de la surface sacro-pelvienne iliaque. *Bulletine et Memoire de la Societe d'Anthropologie de Paris*, **17**(1-2): 1-13.

Ştefănescu, D.G., 2007. *Studiul cariei dentare la populaţia din Moldova aparţinând culturii Sântana de Mureş, sec. III-IV e.n.*, Teză de doctorat (Rezumat). Universitatea de Medicină şi Farmacie ,,Gr. T. Popa" Iaşi.

Temple, D.H., Larsen, C.S., 2007. Dental caries as evidence for agriculture and subsistence variation during the Yayoi period in prehistoric Japan: biocultural interpretations of an economy in transition. *American Journal of Physical Anthropology*, **134**: 501-512.

Temple, D.H., 2011. Variability in Dental Caries Prevalence between Male and Female Foragers from the Late/Final Jomon Period: Implications for Dietary Behavior and Reproductive Ecology. *American Journal of Human Biology*, **23**: 107-117.

Trotter, M., Peterson, R.R., 1969. Weight of bones during the fetal period. *Growth*, **33**: 167-184.

Turner, C.G., 1979. Dental Anthropological Indications of Agriculture among the Jomon People in Central Japan: X. Peopling of the Pacific. *American Journal of Physical Anthropology*, **51**: 619-636.

Ubelaker, D.H., 1979. *Human Skeletal Remains: Excavation, Analysis and Interpretation*. Smithsonian Institute Press.

Waldron, T., 2009. *Palaeopathology*. Cambridge University Press.

Walrath, D.E., Turner, P., Bruzek, J., 2004. Reliability test of the visual assessment of cranial traits for sex determination. *American Journal of Physycal Anthropology*, **125**: 132-137.