

Hereditary and Environmental Dental Findings in Identification of Human Remains

H. Brkić¹, J. Keros¹, Z. Kaić¹, and J. Čadež²

¹ Department of Dental Anthropology, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

² Institute for Forensic Medicine and Criminology, Medical School, University of Zagreb, Zagreb, Croatia

ABSTRACT

The paper presents the results on hereditary and environmental dental findings in identification of human remains exhumed from mass graves in the Republic of Croatia. The total of 17,880 teeth from all the categories (incisors, canines, premolars and molars) was examined. Hereditary findings of the teeth such as shape, size, position, as well as age were used in all of the cases confirming and completing the identification. In only 15% of the cases they were the starting points for the identification that would be later confirmed with another 3 – 5 traditional identification procedures. Disturbances in tooth eruption were recorded in 22% of the cases, impaction of teeth in 10%, and retarded eruption of teeth in 12%. Disturbances of tooth position were recorded in 65% of the cases. Tooth rotation in 26% and diastema mediana in maxilla or mandible in 39%. Disorders of tooth number in the form of unilateral and bilateral missing of lateral maxillary incisors were recorded only in 2% of the monitored cases. Abnormalities of the tooth shape were found in 11% of the cases. The majority of them were found on the tooth crowns 6%, and less on the tooth roots 5%. Environmental dental findings that were the most significant for the identifications were prosthetic appliances in 30% of cases. Prostheses were helpful in the identification of 3% of the cases, while crowns and bridges were helpful in 27% of the cases. Ante mortem teeth extractions were helpful in 25% of the cases. Teeth restorations were recorded in 20 % of the identified cases, amalgams in 19% and aesthetic fillings in 1%. Dental caries was helpful in only 10% of the cases, superficial caries in 3% and caries of dentin in 7% of cases.

Introduction

The macromorphology of human teeth is of great importance to the scientific disciplines of anatomy, dentistry, physical anthropology and forensic medicine. The task of odontography is to allow a precise identification of each tooth, whether it is deciduous or permanent, maxillary or mandibular, left or right, and to give its exact position within the dentition^{1,2}. At a superficial level, the teeth of different individuals may appear similar, while upon closer examination they exhibit great variation in both – form and size. The natural teeth are the most durable organs in the bodies of vertebrates, and the understanding of the man's own past and evolution relies heavily upon remnant dental evidence found as fossils. Teeth can persist long after other skeletal structures have succumbed to organic decay or destruction by some other agency, such as fire³. Hereditary dental characteristics, in addition to environmental factors such as professional dental care, are the best key for dental identification^{4,5}. The aim of this study is to present hereditary and environmental dental findings that were helpful in identification of human remains exhumed from mass graves in Croatia.

Material and Methods

The sample of this research consisted of 770 human remains exhumed from more than 60 mass graves. Most of the mass graves were found in the eastern and southeastern parts of the territory of the Republic of Croatia (Eastern and Western Slavonia, Banovina, Kordun, Lika) that were occupied for the whole duration of the recent war. After the graves were opened, the remains were carefully exhumed and put in black plastic bags in which they were transported to the Institute for Forensic Medicine and Criminology at the School of Medicine in Zagreb. A

forensic odontologist participated in the identification process by carrying out dental identification. The total of 17.880 teeth from all the groups (incisors, canines, premolars and molars) was examined. The post mortem analysis of dentition and jaws was performed according to the American Board of Forensic Odontology – ABFO guidelines⁶. All oro-dental characteristics were carefully recorded in the postmortem Interpol Disaster Victim Identification forms and in the computer program CAPMI 4.0⁷.

All post mortem dental findings were classified according to their origin (hereditary and environmental): dental anomalies (malocclusions, abnormalities of the tooth shape, disorders of tooth number, disturbances in tooth eruption, and disturbances in tooth position; dental restorations, ante mortem missing teeth, prosthetic appliances, ante mortem attrition of dental tissues^{8–11}.

Results

Dental identification of the bodies exhumed from the mass graves was achieved in 25% of the cases in which the bodies were primarily identified by comparison of ante mortem and post mortem dental findings¹².

The distribution of the most common environmental dental findings for identification is presented in Table 1. The most significant dental characteristics for identification were prosthetic appliances – their sizes, shapes and materials (30%). Prostheses were helpful in the identification of 3% of the cases, while crowns and bridges were helpful in 27% of the cases. Ante mortem teeth extraction or ante mortem missing teeth were helpful in 25% of the cases. The most of the extracted teeth were premolars and molars and they were helpful in 18% of the cases, while the extractions of the front teeth helped in the identification of 7% of the

TABLE 1
THE DISTRIBUTION OF THE MOST COMMON ENVIRONMENTAL DENTAL FINDINGS
FOR IDENTIFICATION

PA 30%	EX 25%	RE 20%	CA 10%
Prostheses 3%	Frontal teeth 7%	Amalgams 19%	Superficial caries 3%
Crowns & bridges 27%	Distal teeth 18%	Esthetic filings 1%	Caries of dentin 7%

Legend:

PA – percentage of prosthetic appliances; EX – percentage of ante mortem teeth extractions
RE – percentage of restorations; CA – percentage of dental caries

TABLE 2
THE DISTRIBUTION OF THE MOST COMMON HEREDITARY DENTAL FINDINGS
FOR IDENTIFICATION

DTE 22%	DTP 65%	DTN 2%	ATS 11%
Impaction of teeth 10%	Rotation 26%	Supernumerary teeth /	Tooth crowns 6%
Retarded eruption 12%	Diastema 39%	Missing teeth 2%	Tooth roots 5%

Legend:

DTE – disturbances in tooth eruption; DTP – disturbances of tooth position (malocclusion)
DTN – disorders of tooth number; ATS – abnormalities of the tooth shape

cases. Teeth restorations were recorded in 20% of the identified cases, amalgams in 19% and aesthetic filings in 1%. Dental caries was helpful in only 10% of the cases, superficial caries in 3% and caries of dentin in 7% (Table 1).

The distribution of the most common hereditary dental findings for identification is presented in Table 2. Hereditary findings of the teeth such as shape, size, position, as well as age were used in all of the cases confirming and completing the identification. In only 15% of the cases they were the starting points for the identification that were later confirmed by another 3–5 traditional identification procedures. Disturbances in tooth eruption were recorded in 22% of the cases, impairment of teeth in 10%, and retarded

eruption of teeth in 12%. Disturbances of tooth position or malocclusions were recorded in 65% of the cases, tooth rotation in 26% and diastema mediana in maxilla or mandible in 39%. Disorders of tooth number in the form of unilateral and bilateral missing of lateral maxillary incisors were recorded only in 2% of the monitored cases. Abnormalities of the tooth shape were found in 11% of the cases. The majority of them was found on the tooth crowns (size, shape and hypoplasions) 6%, and less on the tooth roots (taurodontism, supernumerary roots) 5% (Table 2).

Discussion

According to the data from literature as well as to the own results achieved

through the immense process of identification of war victims in Croatia, the dental analysis seems to be the key procedure in the identifications after mass disasters^{4,12,13}.

There are numerous historical accounts of famous persons being identified post mortem by the recognition of certain peculiarities within their dentitions. However, it is not merely enough for various combinations of teeth, dental restorations and prosthetic appliances to be highly individual in order for them to find application in the post mortem identification of the dead (human remains)^{14–18}.

In the absence of ante mortem dental records such as dental charts, x-rays and models, photographs and testimonies obtained from relatives through well conducted interviews can also serve as important ante mortem data. Apart from

dental characteristics, the neighboring bone parts of the craniofacies are also used in the identification process^{19,20}.

Good knowledge of all the segments of odontology, including all anthropological dental traits, possibility of age and sex determination by dental and craniofacial characteristics, pathology of the organs in the oral cavity, treatment techniques, kinds of materials used for restorations of teeth crowns and root filings are prerequisites for achieving better quality and quantity of dental identifications^{21,22}.

To conclude, the role of the forensic odontologist as a member of the identification team (DVI team) is very important. The results of this paper show that apart from being a good dental practitioner, forensic odontologist needs to be an expert in anthropology, especially in dental anthropology.

REFERENCES

1. ALT, K. W., F. W. ROSING, M. TESCHLER-NICOLA: Dental anthropology – Fundamentals, limits, and prospects. (Springer, Wien, New York, 1998).
2. BRKIĆ, H., J. KEROS-NAGLIĆ, Acta. Stomatol. Croat., 33 (1999) 363.
3. CHAPENOIRE, S., Y. SCHULIAR, J. M. CORVISIER, Am. J. Foren. Med. Path., 19 (1998) 11.
4. BRKIĆ, H., D. STRINOVIĆ, M. ŠLAUS, J. ŠKAVIĆ, D. ZEČEVIĆ, M. MILIČEVIĆ, Int. J. Legal. Med., 110 (1997) 47.
5. WHITTAKER, D. K., D. G. MCDONALD: A color atlas of forensic dentistry. (Wolfe Medical, London, 1995).
6. ABFO, J., Am. Dent. Assoc., 125 (1994) 1244.
7. SOLHEIM, T., J. Forensic. Odontostomatol., 15 (1997) 5.
8. PINDBORG, J. J.: Pathology of dental hard tissues. (Munksgaard, Copenhagen, 1970).
9. NEVILLE, B. W., D. D. DAMM, C. M. ALLEN, J. E. BOUQUOT: Oral and maxillofacial pathology. (W. B. Saunders, Philadelphia, 1995).
10. CLEMENT, J. G., D. L. RANSON: Craniofacial identification in forensic medicine. (Arnold, New York, 1998).
11. KEROS-NAGLIĆ, J., D. IVANKOVIĆ, H. BRKIĆ, Z. AZINOVIĆ, B. LAZIĆ, I. VINTER, Coll. Antropol., 20 (1996) 387.
12. BRKIĆ, H., D. STRINOVIĆ, M. KUBAT, V. PETROVEČKI, Int. J. Legal. Med., (2000) (in press).
13. CLARK, D. H., Int. Dent. J., 44 (1994) 241.
14. UBELAKER, D. H., J. Forensic. Sci., 41 (1996) 60.
15. ŠUTALO, J., H. BRKIĆ, Coll. Antropol., 19 (1995) 253.
16. KAIĆ, Z., H. BRKIĆ, Z. POJE, V. NJEMIROVSKIJ, V. DORN, Coll. Antropol., 20 (Suppl.) (1996) 87.
17. POJE, Z., H. BRKIĆ, Z. KAIĆ, Z. SINGER, Coll. Antropol., 20 (Suppl.) (1996) 93.
18. BRKIĆ, H., Z. KAIĆ, Z. POJE, Z. SINGER, V. NJEMIROVSKIJ, V. DORN, Coll. Antropol., 20 (Suppl.) (1996) 55.
19. BRKIĆ, H., Z. KAIĆ, Z. POJE, Z. SINGER, Angle. Ortod., 64 (1994) 371.
20. WHITTAKER, D. K., B. H. RICHARDS, M. L. JONES, Br. J. Orth., 25 (1998) 11.
21. BENTHAUS S., A. DUCHESNE, B. BRINKMANN, Int. J. Legal. Med., 111 (1998) 157.
22. ERMENC, B., K. RENER, Forensic. Sci. Int., 103 (1999) S67.

H. Brkić

Department of Dental Anthropology, School of Dental Medicine, University of Zagreb, Gundulićeva 5, 10 000 Zagreb, Croatia

PRIROĐENA I STEČENA DENTALNA OBILJEŽJA KORIŠTENA U IDENTIFIKACIJI LJUDSKIH OSTATAKA

S A Ž E T A K

U ovom radu prikazani su rezultati prirodnih i stečenih obilježja zubi koji su pripomogli u identifikaciji ljudskih ostataka ekshumiranih iz masovnih grobnica na teritoriju Republike Hrvatske. Uzorak je ukupno sačinjavalo 17 880 trajnih zubi svih skupina (sjekutići, očnjaci, pretkutnjaci i kutnjaci). Prirodna obilježja zubi kao što su njihov oblik, veličina i položaj rabljeni su za identifikaciju i određivanje dentalne starosti u trenutku smrti. Svega u 15% promatranih slučajeva ovakva su obilježja bila početna točka za postizanje identiteta, a kasnije su još nadopunjavana s drugih 3–5 klasičnih identifikacijskih postupaka. Greške u nicanju zubi zabilježene su u 22% slučajeva, impaktirano je bilo 10%, a zaostalo nicanje zabilježeno je u 12% slučajeva. Malokluzija je zabilježena u 65% slučajeva, a od toga rotacija zubi je bila u 26%, a dijestema medijana u gornjoj i donjoj čeljusti je bila u 39% slučajeva. Poremećaji u broju zubi u obliku njihova manjka zabilježen je u 2% promatranih slučajeva. Odstupajući izgled zuba pronađen je u 11% slučajeva, izgled zubne krune odstupao je u 6%, a korijena svega 5% slučajeva. Od stečenih obilježja zubi najdominatniji su bili protetski nadomjesci 30%, od toga mobilne proteze poslužile su u identifikaciji 3% slučajeva dok su krunice i mostovi bili znatno zastupljeniji i poslužili su u identifikaciji 27% slučajeva. Zaživotne ekstrakcije zubi pripomogle su u postizanju identiteta 25% slučajeva, a aloplastični ispuni 20% slučajeva. Najučestaliji su bili amalgamski ispuni 19%, a estetski ispuni svega 1% slučajeva. U postizanju identiteta zubni karijes je pripomogao u 10% slučajeva.