CURRENT CONTROVERSIES AND APPROACHES TOWARDS DENTAL AGE ESTIMATION IN FORENSIC CASES

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Abstract

Introduction: Personal identification and age estimation in forensic medical practice are some of the challenging tasks for every expert in the field. Given the undergoing legal investigation, it is important for the most precise conclusions to be drawn.

Materials and Methods: For the period 01.01.2015 – 08.05.2018 in the Department of Forensic Medicine and Deontology at University Hospital Aleksandrovska – Sofia, 58 autopsies on deceased of unknown identity have been performed. For the purpose of age estimation full dental examinations have been performed and the age of each corpse has been established via Takei's morphology method.

Results: Following the pattern requested by the Takei's method, all 58 cases' age has been estimated, with ages varying between 34 and 80+ years. Later, 41 cases have been identified in the course of investigation. In 7 cases the deviation has been within plus (+) 5 years, in 3 cases – minus (-) 5 years, and in the rest 31 cases the deviation has been found to be within more than ± 10 years.

Discussion: This study has revealed that the most commonly used method in age estimation has shown certain deviations which are not to be underestimated. A wild range of possible age would consequence in difficulties during the investigation process. Invasive techniques and such relying on special equipment are practically impossible to be applied in everyday practice due to various reasons.

Conclusion: A profound study on population must be performed in order for up-to-date information to be gathered that would result in better age estimation and personal identification process prior to performing a DNA-analysis.

Keywords: *age estimation, forensic medicine, current approach*

INTRODUCTION

The examination of deceased of unknown identity comprises a significant part of the forensic practice. Given the versatile changes that occur to the body postmortem, this task is often found to be of a challenge (1). It is an obligation for the forensic specialist to provide as accurate information as possible in order for further investigation to be able to establish the identity of the unknown body (2). The majority of cases that require such lead of examination are such of decomposition, even to a degree of skeletisation, or of severe mechanical or thermal trauma of the head (3).

In numerous cases facial recognition is practically impossible. That is why the application of scientific methods in gaining the most specific and objective information is required (4). In forensic practice the method which has proven its utmost credibility in terms of establishing unknown identity is the DNA-analysis (5). Due to the financial impact and potential psychological trauma to tested suspected relatives, the range of possible identities for that specific body must be narrowed prior to performing the DNA-analysis (5, 6, 7).

One of the indispensable characteristics to be determined prior to a DNA-test is the establishment of the age of the unknown body (8, 9). There are various methods to be applied in that endeavor but most commonly teeth are the object of examination for that purpose (10, 11, 12). In the following research the current state in dental age estimation in Bulgarian forensic medical practice has been presented.

MATERIALS AND METHODS

For the period 01.01.2015 – 08.05.2018 in the Department of Forensic Medicine and Deontology at University Hospital Aleksandrovska – Sofia, 58 autopsies on deceased of unknown identity have been performed. For the purpose of age estimation full dental examinations have been performed.

The age of each corpse has been estimated via Takei's morphology method, with the attribution of an established coefficient to every tooth that is present in the oral cavity, as presented in Table 1. Later the estimated age has been compared to their real age, after the identification process has been completed. Given the gained information, a statistical analysis has been performed.

	CALCULATING TABLE FOR AGE ESTIMATION						
	Tooth name	Tooth condition	Attrition Degree **A**	Attrition Degree **B**	Attrition Degree **C**	Caries, Filling, Crown	Stump of tooth, Pontic, Denture Missing
UJ Left	7		-2.47	-0.54	2.7	-0.30	3.31
	6		-0.42	0.14	1.02	-1.23	3.08
	5		-1.05	0.13	-0.07	0.83	0.67
	4		-0.58	0.04	1.19	-0.66	0.76
	3		-0.95	-0.71	-0.64	1.41	3.11
	2		-0.55	0.56	-0.34	0.36	-0.05
	1		1.01	-0.06	2.69	-0.93	-1.84
UJ Right	1		-1.66	-0.58	-0.43	1.20	2.71
	2		0.53	-0.69	2.40	-1.18	0.44
	3		-0.54	-0.46	-0.34	1.51	1.30
	4		-0.44	-0.91	1.89	0.55	0.40
	5		-0.52	-0.49	1.88	0.59	0.25
	6		-1.12	0.23	2.10	-0.33	0.74
	7		-1.24	-0.76	1.17	1.24	1.38
LJ Right	7		-0.11	0.24	1.49	-1.50	0.94
	6		-0.97	2.50	1.72	-1.21	0.04
	5		-1.48	-0.65	-0.94	1.38	1.54
	4		0.34	-1.14	1.33	0.57	-0.77
	3		0.25	-0.45	0.29	-1.62	1.10
	2		0.03	-0.36	1.27	0.50	-1.05
	1		0.61	0.22	0.27	1.48	-3.45
LJ Left	1		-2.33	-0.34	0.11	2.94	5.51
	2		-1.03	0.18	0.28	-1.76	2.54
	3		-1.48	-0.34	0.16	2.27	2.30
	4		-1.54	-0.42	1.08	1.42	2.58
	5		-0.45	0.39	2.88	-0.89	0.64
	6		-0.08	0.66	-1.36	0.02	-0.01
	7		-0.74	-1.05	1.95	0.73	0.38
Mean 38.78 Multiple Correlation coefficient 0.814							

Table 1. Takei's morphology method for age estimation.

RESULTS

Of all 58 examined cases, 41 have been later legally established by the police investigation. In 2 cases a variation of –(minus) 10 years has been found and 3 cases it has been –(minus) 5 years. In all the other cases a positive variation between the estimated and the real

age has been established as follows: in 7 cases has been +(plus) 5 years; in 15 cases has been +(plus) 10 years; in 11 cases has been +(plus) 15 years; in 3 cases has been +(plus) 20 years. In only 24% of the cases the established variation is in the range of ± 5 years. In contrast, 42% have shown a variation in ± 10 years, and 34% – more than 15 years (Figure 1).

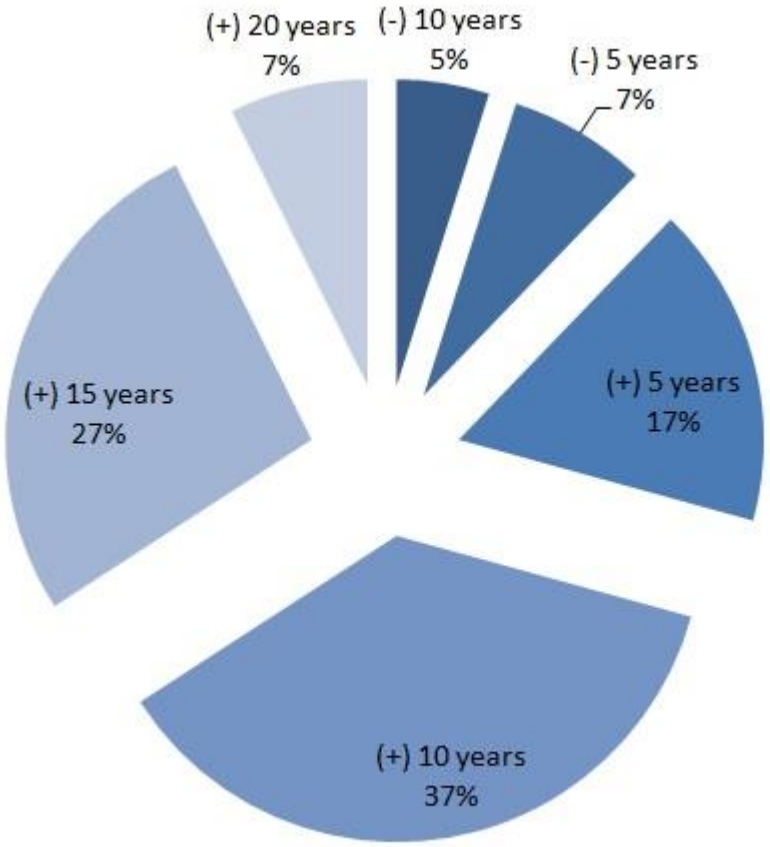

Figure 1. Variation of the estimated age compared to the real age of the deceased.

DISCUSSION

Chronological age is one of the first characteristics that is to be determined in examining a deceased of unknown identity. The results from the research that has been performed have shown certain ambiguity.

Takei's morphology method that has been applied in this research is the most preferred one. It lacks any special equipment or necessary further tests, which make it suitable for any environmental situations. Furthermore it does not require any additional funding, which is of an advantage, given the current health care management system. The forensic doctor examines each tooth individually, with categorizing any pathological or traumatic change, or any dental treatment that might have occurred in the past. This personal, subjective evaluation is the most prominent disadvantage of the method. It is of no doubt that given the same appearance of a tooth, it might be evaluated differently in separate examinations. Especially the evaluation of the attrition degree shows greater discordance. Even though there is a worked-up scheme that specifically states which parts of the tooth surface must be affected by the attrition, in order for the degree to be determined, it is a matter of rather subjective assessment.

Another serious concern in terms of applying Takei's morphology method is the population on which the results are based. All the participants in the original research that has lead to the coefficients given in the popular table are of Japanese descent. Given the populational, genetic and nutritional differences with Bulgarian population, it is of no doubt that the results might show significant deviations. In the group that has been examined it is presented that only 24% have been proofed with chronological age similar to established one upon forensic examination. In 34% of the cases the established difference is more than 15years, even 20 years, which is a serious issue, given the importance of accuracy that is absolutely obligatory in cases that are a matter of investigation.

The other widely applied method for age estimation by examining teeth is that of Gustafson. It encompasses the evaluation of the following characteristics: 1) Attrition; 2) Paradentosis; 3) Secondary dentine; 4) Root resorption; 5) Transparency of root; 6) Cementum apposition. Each of these is assessed in terms of change, form lack of such to maximum appearance. As it is obvious, the teeth characteristics that are undergoing forensic examination are either subjective to personal evaluation or require equipment and additional tests. The latter is the reason which narrows the application of this method in everyday practice.

The results of the current study have outlined the necessity of a profound study among Bulgarian population. The study should include precise dental examination, with thorough description of every single change, pathological or traumatic. Another aspect of the study should focus on the dental treatment practice and its impact on the dental status. After gathering sufficient data, it is possible for a more accurate conclusion to be drawn upon which is the most suitable method for age estimation in everyday forensic practice. Furthermore, a general conclusion might be drawn about the possibility for more objective and determining manner for base-line identity establishment.

In recent years it is more and more valuable to manage the pool of suspected identities prior to performing a DNA-analysis. Given the current state of fund raising and budget distribution among the sectors of health care, the development of accurate models and methods for age estimation at a minimum cost is crucial.

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