

Medical odonto-dental identification in telemedicine: forensic and ethical aspects

Andrei Kozma¹, Horia Lăzărescu², Oana-Maria Isailă^{3*}, Călin Popovici^{1,4}

Abstract: Identity and biological individuality of a person may be terms which are ambiguous, difficult to define and demonstrate, but they also have concrete and objective valency when subjected to legal medicine

Telemedicine involves the use of electronic communication services between the physician and the patient who are based in different locations. It is an adaptable instrument that can also be applied in anthropology. Identifying someone using dental records and files, implies the existence of an infrastructure for storage and transmission of medical data by the dental practitioner. The purpose of this paper is to expose the usefulness of the odonto-dental forensic identification that could be obtained through telemedicine. Several aspects with increased utility in odonto-dental identification (dental abnormalities, dental procedures) will be presented and the medical-legal and ethical aspects of the use of telemedicine in odonto-dentistry with implications including in legal medicine will be briefly discussed.

Key Words: telemedicine, dental identification, legal medicine.

INTRODUCTION

Identity and biological individuality of a person may be terms which are ambiguous, difficult to define and demonstrate, but they also have concrete and objective valency when subjected to legal medicine.

In what concerns forensic identification, including identifying human remains, an important role is held by analysing dentition in cases where this thing is possible.

Teeth are tough structures, well protected by the mouth, more resistant to the decaying processes than the rest of the tissues; they have individual traits [2], presenting a different morphology from one person to another, as well as in the same person [3]. Given

the lifetime degradation processes, new elements of dental uniqueness (color changes, dental works) that increase their role in identifying a person appear [4]. For the accuracy of the identification process in treated dental cases, the results of imaging consultations and investigations performed are of great use and involves the use of electronic communication services between the physician and the patient who are based in different locations. It is an adaptable instrument that can also be applied in anthropology [8]. It is an adaptable instrument that can also be applied in anthropology. Identifying someone using dental records and files, implies the existence of an infrastructure for storage and transmission of medical data by the dental practitioner.

1) "Alessandrescu- Rusescu" National Institute for Mother and Child Health, Research Department in Social Paediatrics and Obstetrics, Bucharest, Romania

2) National Institute for Recovery, Physical medicine and Balneoclimatology, Bucharest, Romania

3) "Mina Minovici" National Institute of Legal Medicine, Bucharest, Romania

* Corresponding author: "Mina Minovici" National Institute of Legal Medicine, 9 Vitan Barzesti, 4th District, Bucharest, Romania, E-mail: oana_maria.isaila@yahoo.com

4) Romanian Spacial Agency, Bucharest, Romania

All authors have the same contribution

Purpose

The purpose of this paper is to present the value of various aspects of odonto-dental identification that could be obtained through telemedicine and their useful implications in legal medicine.

RESULTS

Telemedicine enables the quick identification of a potential victim when there is imaging data that makes it possible to make a proper comparison of necropsy results. Sometimes the Xray of a single tooth is sufficient for a positive identification (given that there are specific elements that are found in the general population with extremely low prevalence - including, for example, unique dental treatments) in other cases, for a positive identification, more teeth are needed if the established aspects do not have a high degree of individuality. Among the very specific elements for odonto-dental identification we mention:

Number and position abnormalities. These provide greater accuracy for identification, especially if there are records that offer scaling of anatomical situation in different records and angles, or association

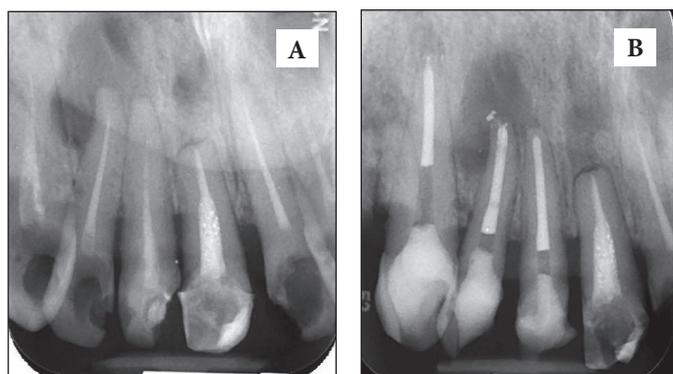


Figure 1. Upper lateral right incisor (1.2) supernumerary - before (a) and after treatment (b).

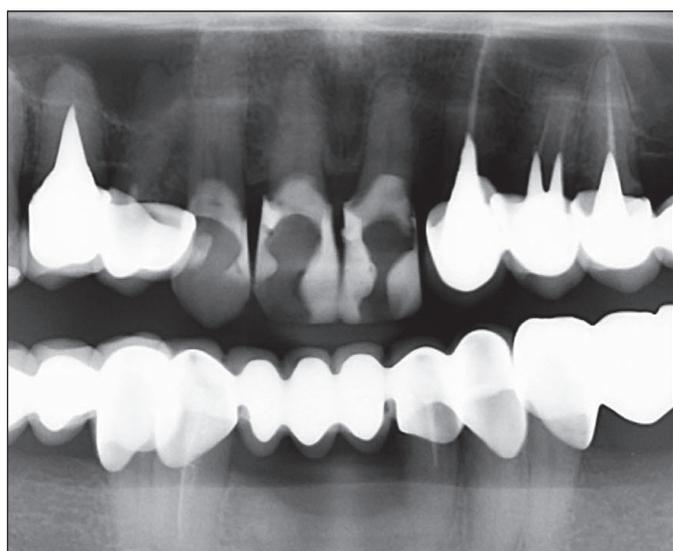


Figure 2. Anodontia (absence) of both upper lateral incisors (1.2 and 2.2).

of records with negative and positive exposures. Figures 1 and 2 show two number abnormalities (Figs 1 - 12 supernumerary, Fig. 2 - anodontia) [11, 21].

Dental position abnormalities

Figure 3 presents a complex association that includes a positional anomaly. The image shows an upper left canine (2.3) included in the jaw bone and the persistence of deciduous teeth (upper left temporary canine, 5.3) highlighted on an orthopantomogram (OPG) associated with detail images that may be decisive for advanced identification. OPG has the advantage of giving an overview of hard tissue in the oral cavity and it can be done with relative ease especially in cases where there are unidentified skulls. In the shown case, the high degree of specificity is given by associating the included tooth with other details: lower first molar left (3.6) with intraradicular screw, bottom right molar (4.6) with incomplete canal obturations and coexisting with included wisdom molars (3.8 and 1.8) or semiincluded wisdom molars (2.8) and anodontia of the right lower wisdom molar (4.8) and of the lower central incisors (7.1 and 8.1). This allows identification with extremely high probability.

Routine X-ray check-ups after root canal procedures. Even a simple, multiple-incidence control image taken after root canal procedure can serve as an effective means of identification, especially if the procedure is the result of an endodontic intervention through the use of the dental microscope.



Figure 3. Orthopantomogram (OPG), an upper left canine (2.3) included in the maxillary bone and the persistence of deciduous teeth (upper left temporary canine, 5.3) and lower central incisors (7.1 and 8.1). In the root canal of the lower left first molar (3.6) there is a screw, the wisdom molar (38) is included in horizontal position.



Figure 4. Superior teeth - the first left upper molar (2.6) with canal obturation performed by microscope (a) with a scalar-negative radiography (b).

Figure 4.a shows a canal obturation on the first upper right molar (2.6) with a supernumerary root with a multi-incidence (radial and distal) x ray accompanied by scalar negative x ray to determine the root canal length (Fig. 4.b). The appearance of the retromolar bone that indicates the extraction of the upper left wisdom molar (2.8) can be seen as an additional safety feature.

Figure 5 shows the performance of canal obturation on a second lower right molar (4.7) and the radiological control of several incidents, which increases the degree of identification by an appropriate interpretation of the radiological resources. Associating the reconstitution of the first right lower molar (4.6) with corono-radicular reconstruction and ceramic metallic crown + 3rd molar anodontia (4.8).

In cases that have benefited from endodontic treatments, such as canal obturations, it can be stated that the accuracy of identification is increased due to the lack of postinterventional changes; the filling materials used are preserved, which facilitates the identification process for a longer period even at higher temperatures [9–13].

Dental implants

Figure 6 shows the case of a 38 year-old female patient with an implant on the upper left central incisor (2.1) and upper right central incisor canal obstruction (1.1) both with a total metallic ceramic physiological restoration (burnt porcelain on metallic head). This combination allows identifying the individual in question, especially because we have images from different incidents. Inadequate mezial face obturation of the upper lateral incisors can also increase the accuracy of the identification, but it should be noted that, if they



Figure 5. 4.7 canal obturation performed using a microscope associated with a tooth with an old canal obturation (4.6) and corono-radicular reconstruction and a metal-ceramic crown (a) accompanied by a negative radiographic image (b).

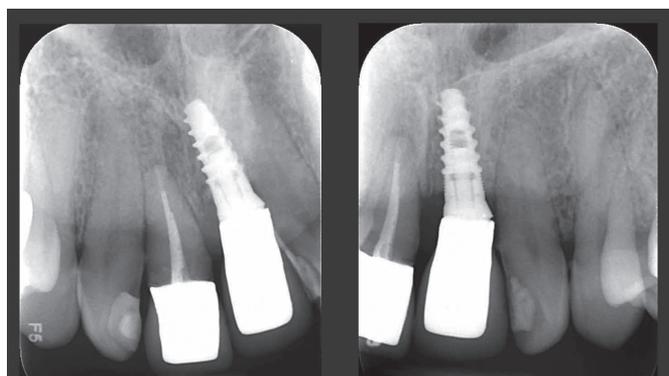


Figure 6. Female patient, 38 years old - implant on upper left central incisor (2.1) radiographic image from two incidents.

are later corrected, they can no longer be considered for a positive identification.

Foreign bodies in root canals

The notion of foreign body can be different, depending on the point of view of its origin. Their existence may be of voluntary origin for therapeutic purposes (interradicular screws, root-coronary reconstructions, implants, etc.) or may be the result of wrong / accidental therapeutic maneuvers. In this respect two cases will be presented. The first is a left upper lateral incisor (2.2) (Fig. 7) with a screw inserted for therapeutic purposes in the root canal and covered by a metal-ceramic crown. The preexistence of apical resection with persistent periapical bone injury accompanied by overlapping canal obturation and the coexistence of prosthetic treatment on the upper right central incisor (2.1) gives increased accuracy in identifying the individual.

The second example shows an upper right first molar (1.6) treated endodontically with canal obturation followed by the insertion of an interradicular screw (Fig. 8), to strengthen the coronary obturation following

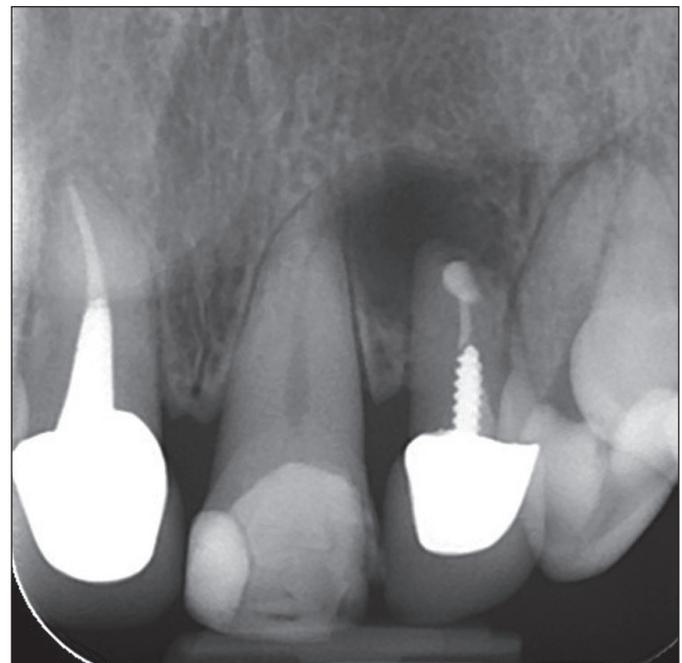


Figure 7. Upper lateral left incisor (2.2) with screw inserted for therapeutic purpose in the root canal and covered by a metal-ceramic crown.

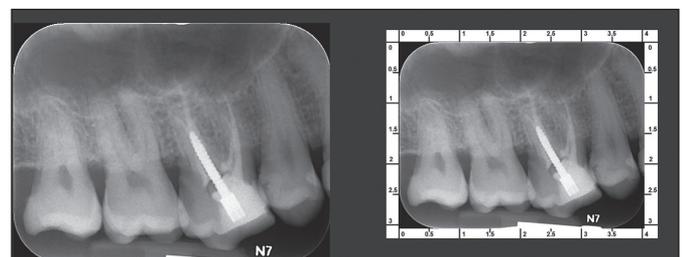


Figure 8. Upper right first molar (1.6) treated endodontically with canal obturation followed by insertion of an interradicular screw.

the endodontic treatment. The radiographic image accompanied by scaling gives a certainty on the length of the canal which increases the probability of identification.

DISCUSSIONS

Dental X-rays are insufficiently used for identification although they have demonstrated their usefulness in the absence of an accessible database.

In order to be made available to the forensic practitioner to identify an alleged person, and implicitly to create a database to be used in telemedicine, it is first necessary that the patient sign an informed consent, this being the main practical limitation of the creation of databases for medico-legal odonto-dental telemedicine. It is extremely difficult to obtain consent for the use of specific imaging clichés for identification purposes, in the absence of laws explicitly requesting this.

Dental morphology, in some situations, can give accuracy in identification similar to DNA testing or dermatoglyphs [3]. Variations in dental morphology are of interest in anthropology in order to confirm the identity of the individual following the comparison of x-rays performed during lifetime with those performed postmortem. Some dental abnormalities, depending on their severity, may be specific for certain population groups [14], others may exist in the family, being genetically determined [15], allowing identification with a reasonable degree of probability in the absence of ante-mortem imaging data. If the presence of dental implants is found, it is useful to know the type of implant and the information about its restoration for the accuracy of the odonto-dental identification. Also, in order to identify the type of implant, it is necessary to perform several x-rays from different incidents, to detect form and design [17]. Dental foreign bodies are often incidentally detected on radiographs. Located at the level of the pulp chamber or root canals, they may be broken instruments, materials used to fill the canal, or foreign objects introduced by the patient, the latter most commonly encountered in children. Also in these cases x-rays are useful, especially if the foreign body is radio-opaque [18]. Being a distinctive, super possible imaging aspect when comparing ante-mortem and post-mortem radiographs is an element that helps individualize and identify the person.

The imaging aspects useful in identification can be achieved much easier with the widespread use of telemedicine services. The first studies on teledentistry emerged in the 1990s when the US Army established the first distance dental medicine project, "Total Dental Access", in the Department of Defense that allowed dental practitioners in a dental clinic from a military base to consult with dentists from other geographic areas [19]. In Romania, in 2012, the National Union of Dental Associations launched a telemedicine system in dentistry. This allows a live video chat between an expert

group and a dentist on the management of some special cases. Therefore, it provides the requester dentist with the complex therapeutic solutions of recognized specialists in all areas of dental medicine, enhancing patient care and enabling distance learning [20].

Confidentiality is a major task in legal medicine. There is a critic balance between the duty to communicate to the judicial prosecutor or police personal data which experts are obliged to present when under official request and confidentiality of the medical records [21].

From the forensic point of view, telemedicine in dentistry could be extremely useful in difficult identification cases by collaborating with specialists in different dental areas; access to this system could allow, in addition to easier forensic identification, collaboration between dentists and forensic physicians in the analysis of medical malpractice accusations. In medical malpractice legal medicine is implied as an auxiliary of justice and has to give answers to the objectives decided in court. Telemedicine may help to organise the data as much as to protect the data.

However, the use of telemedicine raises a number of ethical issues that have been attempted to be conceptualized and analyzed by the World Medical Association, the guardian of professional medical ethics, which published a Recommendation on Ethics in Telemedicine in 2017 in Copenhagen and amended in 2018 in Reykjavik. It is emphasized that telemedicine is all the more useful as some patients cannot get their own physician, but the gold standard remains the doctor-patient relationship based on direct examination. Physicians have to respect professional ethical values when practicing the profession through telemedicine: knowing the patient's history, trusting the medical act on the one hand and the benefit, non-maleficent offer, respecting the patient's autonomy and practicing the medical act with justice on the other hand, keeping confidentiality [22]. Physicians must respect patient autonomy and free will without abstaining from the benefit of the medical act (the action of doing good to the patient, "The health of my patient is my primary duty," the Geneva Declaration, 1948) [22]. Physicians have, in the medical act, through telemedicine, moral and professional duties such as keeping the case data, the patient's equidistant access to the telemedicine system, to verify that the patient has understood the recommendations and the therapeutical plan, keeping access to the second opinion when needed, the need for direct contact in the physician-patient relationship whenever the medical care requires it for the benefit of the patient (best interest of the patient) without violating the code of ethics of the country in which he practices [22]. At the same time, the level of quality of care should not shrink by telemedicine practice, but on the contrary, increase through the efficiency and the provision of personalized, patient-centered services. Whenever new technologies emerge, professional ethics

rules must be built and revised to include those new technologies and to cover their ethical professional implications [22].

The guide summarizes, at the same time, the main aspects of how to obtain consent, how to preserve the confidentiality of remote medical act (including the management of private data, which must be properly secured before being transmitted by electronic means, which makes it extremely questionable to use some "unsafe" platforms in this respect, such as Facebook® or even public emails), aspects on the autonomy of the physician, the manner in which records are kept, etc. [22].

In conclusion, telemedicine may have an increased utility in the odonto-dental medical forensic identification. Strengths and weaknesses should be carefully highlighted: urgency is an important indication, the severity of cases or the reduced experience of

physicians in dealing with complicated cases, restrictive conditions. Telemedicine must establish and follow protocols and clarify some technical, legal and ethical aspects. Physicians should promote an ethical telemedicine that is in the best interests of the patient [21], that does not harm him/her and which allows a personalization of medical services and an increase in the quality of the medical act. The chosen examples support these values. The usefulness of an ethical telemedicine for legal medicine is increased, especially when it is necessary to identify victims, especially in disasters; in this respect, an interdisciplinary team co-operation involving both specialists, legislators, dental practitioners and family physicians as doctors of the people whose identity is in dispute appears to be a necessity.

Conflict of interest. The authors declare that there is no conflict of interest.

References

1. T. Thomson, S. Black, Forensic Human Identification, An Introduction, CRC Press, Taylor and Francis Group, 2007.
2. Sorin H, Cristian CG, Dan D, Mugurel R. Bitemark analysis in legal medicine - Literature review. Rom. J. Leg. Med. 2008;16, 289–298.
3. Krishan K, Kanchan T, Garg AK. Dental Evidence in Forensic Identification – An Overview, Methodology and Present Status. Open Dent. J. 2015; 9, 250–256.
4. Jurel SK. Role of Dentist in Forensic Investigations. 2012; 3, 3–7.
5. Kannada D. Dental records : An overview. 2010; 2, 5–10.
6. Singh K, Anandani C, Kaur Bhullar RP, Agrawal A, Chaudhary H, Thakral A. Teeth and their Secrets – Forensic Dentistry. 2012; 3, 9–11.
7. Wadhvani S. Maintenance of antemortem dental records in private dental clinics : Knowledge , attitude , and practice among the practitioners of Mangalore and surrounding areas. 2017; 78–82.
8. Rheuban K, Shanahan C, Willson K. Telemedicine: Innovation Has Outpaced Policy. Virtual Mentor. 2014;16(12):1002-1009.
9. Silva RF, Franco A, Picoli FF, Nunes FG, Estrela C. Dental Identification Through Endodontic Radiographic Records: a Case Report. Acta Stomatol. Croat. 2014; 48, 147–150.
10. Ranganath A, Nasim I. Effect of high temperatures on root canal obturation – an aid in forensic identifications. 2017; 7, 256–258.
11. Perlea P, Nistor CC, Cuci I, Iliescu MG, Iliescu AA. Rare multiple internal root resorption associated with perforation - A case report. Rom. J. Morphol. Embryol. 2014; 55, 1477–1481.
12. Perlea P, Coralia Nistor C, Toma C, Dimitriu B. Endodontic configuration of the lower incisors in a Romanian population: A radiological study. Rom. J. Morphol. Embryol. 2013; 54, 775–778.
13. Perlea P, Nistor CC, Imre M, Gheorghiu IM, Iliescu AA. Middle mesial canal of the permanent mandibular first molars: An anatomical challenge directly related to the outcome of endodontic treatment. Rom. J. Morphol. Embryol. 2017; 58, 1083–1089.
14. Puri PM, Shukla SK. Developmental dental anomalies : Some case reports and their potential role in forensic investigations. 2015; 2, 559–561.
15. Garib D, Alencar B, Ferreira F. Associated dental anomalies: the orthodontist decoding the genetics which regulates the dental development disturbances. Dent. Press J. 2010; 138–157.
16. Byraki A, Costea AV, Curca GC, Hostiu C. Morphological analysis of dental implants - forensic significance. Rom. J. Leg. Med. 2010; 18, 207–212.
17. Deepalakshmi T, Prabhakar M. Role of dental implants in forensic identification. J. Forensic Dent. Sci. 2014; 6, 145.
18. Sharmin DD, Sistla S, Gunasekaran R. Unusual Foreign Objects in the Teeth – A Case Report. J. Dent. Oral Disord. Ther. 2018; 5, 1–2.
19. Rocca MA, Kudryk VL, Pajak JC, Morris T. The evolution of a teledentistry system within the Department of Defense. In Proceedings of the AMIA Symposium 921 (American Medical Informatics Association, 1999).
20. Sistem de telemedicina, in premiera in medicina dentara romaneasca. Available at: <http://formare-continua.ro/index.php/informaii-utile/stiri-medicale/625-sistem-de-telemedicina-in-premiera-in-medicina-dentara-romaneasca>. (Accessed: 28th March 2019)
21. Radu CC, Podila C, Camarasan A, Bulgaru-Iliescu D, Perju Dumbrava D. Ethical professional-personal model of making decisions in forensic medicine. Rom J Leg Med. 2017; 25(3)314-316.
22. WMA Statement on the Ethics of Telemedicine – WMA – The World Medical Association. Available at: <https://www.wma.net/policies-post/wma-statement-on-the-ethics-of-telemedicine/>. Accessed on 28th March 2019