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Implant Restorations In Identification Of Forensic Cases

Adli Olguların Kimliklendirilmesinde İmplant Restorasyonları

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ABSTRACT

Forensic dentistry is the application of odontological knowledge to law and criminal events. Identification studies are the main difficulty in evaluating fragmented, mixed or burnt remains in multiple deaths from mass disasters. As part of forensic science, odontological identification consists of comparing pre-death dental information about a missing person with posthumous data from an unidentified corpse or human remains. Dental remains are important findings that survive in destroyed body tissues. They play a fundamental role in identification if findings that are important to diagnose, such as visual or fingerprints, are lost. For this purpose, teeth, radiographic images, dental molds, palate scar, lip scar, bite mark and restorative and prosthetic applications are used. Objective and subjective information about the patient obtained by the dentist or clinical assistant is considered as antemortem legal documents. Dental implants, which are frequently preferred in the treatment of tooth loss today, provide important information in identification studies due to their durable structure and tight stability with the jawbone. In this study, the use and limitations of dental implants in forensic cases were examined.

Keywords: forensic dentistry, identification, dental remains, dental implant

ÖZET

Adli diş hekimliği, odontolojik bilgilerin hukuk ve suç olaylarına uygulanmasıdır. Kitlesel felaketler sonucunda meydana gelen çoklu ölüm vakalarında, parçalanmış, karışmış veya yanmış kalıntıların değerlendirilmesindeki temel zorluk kimliklendirme çalışmalarıdır. Adli bilimlerin bir parçası olan odontolojik tanımlama, kayıp bir kişiye ilişkin ölümden önceki (antemortem) diş bilgilerinin, kimliği belirsiz bir ceset veya insan kalıntılarından alınan ölümden sonraki (postmortem) verilerle karşılaştırılmasından oluşmaktadır. Dental kalıntılar, tahrip olan vücut dokularında sağ kalan önemli bulgulardır. Görsel veya parmak izi gibi teşhis etmekte önemli olan bulguların kaybedilmesi durumunda kimliklendirmede temel bir rol üstlenirler. Bu amaçla, dişler, radyografik görüntüler, dental kalıplar, damak izi, dudak izi, ısırık izi ve yapılan restoratif ve protetik uygulamalardan faydalanılmaktadır. Diş hekimi veya klinik yardımcısı tarafından elde edilen, hasta hakkında objektif ve sübjektif bilgiler antemortem yasal dokümanlar olarak değerlendirilmektedir. Günümüzde diş kayıplarının tedavisinde sıklıkla tercih edilen dental implantlar, dayanıklı yapısı ve çene kemiği ile sıkı stabilite göstermesi nedeniyle kimliklendirme çalışmalarında önemli bilgiler sağlamaktadır. Bu makalenin amacı, dental implantların adli olguların kimliklendirme işlemlerinde kullanımını ve kısıtlamalarını ele almaktır.

Anahtar kelimeler: adli diş hekimliği, kimliklendirme, dental kalıntılar, dental implant

INTRODUCTION

The main purpose of forensic dentistry, one of the important department of forensic medicine, is to provide justice by examining dental evidence for the purpose of handling, examining and evaluating forensic cases. In this field, the legal system and dentistry are interpreted together to create a scientific study area. Identification is first made in all living or dead cases that need to be evaluated in terms of forensic science (Atsü, Gökdemir, & Kedici, 1998).

The use of teeth for identification purposes dates back to ancient times. The first document recorded is the case of Agrippina and Lollia Paulina, mentioned in the Roman history book published by the Roman author Dion Cassius. M.S. In 49 AD, Agrippina, the 4th wife of the Roman Emperor Cladius, killed a wealthy woman Lollia Paulina and used her well-known discolored anterior tooth to identify it (Tuğ & Yaşar, 2006; Verma, Kumar, Rathore, & Pandey, 2014). Dr Paul Revere, who made the first identification procedure with dental findings in the history of dentistry. He identified his friend Dr Warren, who died in the battle of Bunker Hill in 1775, by seeing the prosthetic restoration he

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had done before (Luntz, 1977). Dr. Oscar Amoedo diagnosed 126 people in a fire that occurred in 1897 and wrote "L'art dentaire en medicine legale", the most important book of forensic dentistry, making it heard worldwide (Taylor, 2009).

Today, findings such as external appearance of the case, fingerprint, DNA analysis, tooth and jaw features are used in identification studies (Atsü et al., 1998). Dental remains have a special place in the evaluation of severely fragmented, mixed or burnt remains. Because of its dense inorganic structure, the tooth is less affected by physical factors and external factors than other organs, it preserves its morphological characteristics for a long time and is usually detected with the corpse (Avon, 2004).

Identification Methods

Identification is all of the characteristics that enable a living or dead person to be identified and distinguished from other people. Generally, after death, identification procedures are used in the investigation of criminals, in the field of civil law, border control and country security studies (Tuğ & Yaşar, 2006). These processes do not contain medicinal components; findings such as documents, clothes, personal belongings, photographs, information obtained from family and relatives, records of security guards, doctor or dentist are evaluated first. In post mortem cases, these findings are treated as antemortem information (Tuğ & Yaşar, 2006). As post-mortem information, dental examination, examin of skeletal remains, DNA analysis, body fluid and serological examinations are the most important studies in identification (Avon, 2004).

Identification Methods by Examining the Mouth, Teeth and Jaws

Dental remains are important findings that survive disasters such as fire, explosion and collision that destroy or change body tissues. They play a fundamental role in identification in the event of loss of diagnostic findings such as visual or fingerprints (Avon, 2004; Zhou & Abdel-Mottaleb, 2005).

Objective and subjective information about the patient obtained by the dentist or clinical assistant is considered antemortem legal documents (Avon, 2004). Antemortem recording should include all clinical and radiographic evaluations and applications of the individual's oral and surrounding tissues. Systemic anamnesis information, dentition, working patterns, oral and extra-oral photographs, applied treatment procedures should be properly and accurately recorded and kept for 7-10 years (Avon, 2004). However, dental records to be compared with these postmortem data are not kept regularly in many countries. This limits the active role of forensic dentists in identification studies (Avon, 2004; Taylor, 2009).

Postmortem findings are collected by examining the body. If necessary or preferred, the lower and upper jaw can be removed by facial dissection and/or jaw resection (Bux, Heidemann, Enders, & Bratzke, 2006). Radiographic images of the resected jaws (6 periapical, 2 bitewing and panoramic radiographs) should be obtained (Bux et al., 2006; Schuller-Götzburg & Suchanek, 2007). Examinations and findings on the mouth, teeth and jaw are noted and compared with antemortem findings, if any. In this method, easy, effective and accurate results are obtained by comparing the antemortem and postmortem records of the same individual (Avon, 2004; Zhou & Abdel-Mottaleb, 2005). In cases where antemortem records are not available, studies are carried out to narrow down postmortem dental profile research and to exclude possible suspects by comparing them with antemortem records (Pretty & Sweet, 2001; Taylor, 2009; Zhou & Abdel-Mottaleb, 2005). American Board of Forensic Odontology evaluates the information obtained as a result of the identification studies (Pretty & Sweet, 2001; Taylor, 2009).

1. Positive identification: Antemortem and postmortem findings of the case are sufficient, compatible and purely clear to diagnose. The findings are considered to belong to the same person. Even a tooth with enough specific features can be used for identification.

2. Possible identification: Although antemortem and postmortem findings are similar, they are not sufficient for positive identification.

3. Insufficient evidence: There is not enough evidence for comparison.

4. Negative identification: It has been clearly and definitively determined that the antemortem and postmortem findings compared do not belong to the same individual.

Radiographic Evaluation

Forensic dentists make use of antemortem and postmortem radiography comparison of various parts of the body, including the skeleton, skull, jawbones and teeth, in the identification procedure. This comparison has been shown to be accurate and reliable in several studies (Kirchhoff et al., 2008; Mahoor & Abdel-Mottaleb, 2005; Taylor, 2009). Radiographs obtained using computed tomography are often preferred (Kirchhoff et al., 2008). Findings such as dental features, impacted teeth, root remnants, jawbone structure, sinus cavities, shape of the restorations, root canal treatment, bone fracture line, surgical procedures and dental implant treatments can only be evaluated by radiographic examination (Savio, Merlati, Danesino, Fassina, & Menghini, 2006; Taylor, 2009). Especially the antemortem and postmortem examination of the frontal sinuses. Radiographic image comparison provides convenience in identification procedures (Carvalho, Jacometti, Franco, Da Silva, & Silva, 2019). Nowadays, the increase in dental implant treatments has increased the level of consideration in forensic cases (Misch & RESNIK, 2020).

Dental Implant Applications

It aims to ensure that dentistry patients have healthy mouth, teeth and jaw structures and gain function, phonation and

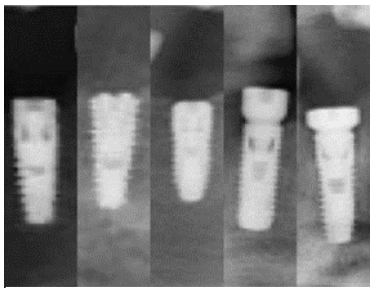
aesthetic needs. Tooth loss is the most common dental problem people encounter. In line with advancing technology, new prosthetic materials, and changing patient demands, there is an increasing trend towards dental implants in the treatment planning of edentulous areas (Misch & RESNIK, 2020). Pure titanium or titanium alloys are widely used in the medical field due to their biocompatibility, corrosion resistance and mechanical properties, as well as in dental implant production (Özcan & Hämmerle, 2012) (Table 1).

Table 1. Mechanical specifications of Titanium-Aluminum-Vanadium (Ti-6Al-4V) alloy, which is frequently preferred as dental implant material (Duymuş & Güngör, 2013).

Specifications	Ti-6Al-4V
Density (gr/cm³)	4,5
Casting temperature (˚C)	1600-1700
Tensile stress (MPa)	1000
Proportional limit (MPa)	920
Elasticity Module (GPa)	85-115
Hardness (VHN)	-
Flexibility (%)	14

Although machine-made dental implants do not have personal features, their resistance to corrosion and their high melting point make them an element of evaluation in forensic cases. Excessive heat causes the pulp tissue to evaporate, causing the tooth crown and root to break up and split. Unlike traditional restorative materials such as amalgam, composite and gold, which can melt or deteriorate at high temperatures, titanium and its alloys, which are widely used in the production of dental implants, have a melting point above 1650 ° C, resisting high thermal trauma. In addition, the presence of the criminal or corpse in the jawbone provides an advantage in identification studies in order not to cause confusion (J. Berketa, James, & Marino, 2010).

When evaluating the laser engraved serial number on the dental implant body before and after high temperature using a microscope attached with a digital camera, it was shown that the serial number was permanent even after exposure to high temperature. Implants produced in accordance with this design can be used as sufficient and accurate findings that facilitate identification studies, thanks to their serial numbers (J. Berketa et al., 2010). However, most of the implant brands used do not have serial numbers on the implant bodies. This situation causes difficulties in the identification of the implant. In another study, it was stated that implants without serial numbers can be classified according to their brands as a result of radiographic examinations (J. W. Berketa, Hirsch, Higgins, & James, 2010) (Figure 1).



a b c d e

a. Bredent (KG GmbH & Co., Senden, Germany)

b. Megagen Implant Co., Ltd, Seoul, South Korea

c. Nucleoss T-6 (Nucleoss, Izmir, Turkiye)

d. Medentika GmbH, Hügelsheim, Germany

e. Osstem Implant Co., Ltd. Seoul, Korea

Figure 1. Implants designed by different implant manufacturers

Macro design; Implant body designs (screw, cylindrical, combination of these designs), implant diameter and length, thread design (thread shape, thread pitch, thread depth, thread width and thread pitch), crestal module design (implant neck design) and type of prosthetic interface and,

Micro design; It can be distinguished from each other by processes such as roughening, coating, sandblasting(CE, 2011).

Determining the implant brand can lead to contact with implant company employees and possible implant practitioners. The number of implants applied, advanced surgical procedures (such as sinus lifting, soft and / or hard tissue augmentation, titanium mesh and pin applications), over-implant restorations used will be useful in identification procedures (Figure 2-3).

Figure 2. Restoration of the lower and upper jaw bone of a total edentulous patient with dental implant treatment.

Figure 3. Restoration of the partially edentulous lower and upper jaw bone with dental implant treatment.

Preparation of a catalog containing the description of the implants used, clinical and radiographic images will also be useful in identifying the implants. Clues obtained from the type of implants used in unidentified cases will contribute to the research (Nuzzolese, Lusito, Solarino, & Di Vella, 2008).

One of the current studies in this field is an implant recognition software consisting of a large database that determines different implant systems and is fed with a series of questions. In addition, radiographic and clinical images of implant systems are also included in the software database. At the end of the study, a complete dental implant identification system is obtained, which can aid in the recognition of cases and simplify the job of a forensic dentist (Gattani & Deotale, 2016; Michelinakis, Sharrock, & Barclay, 2006).

CONCLUSION

High-tech dental implants, which are increasingly used in the treatment of tooth loss, showing firm stability with the jawbone, resistant to abrasion and burning, provide reliable clues through brand, serial number and radiography are successfully used in identification studies of forensic cases.

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