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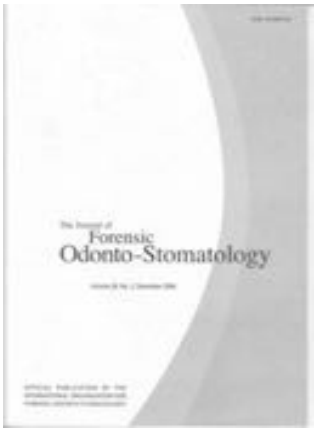

THE JOURNAL OF FORENSIC ODONTO-STOMATOLOGY

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JOURNAL of FORENSIC ODONTO-STOMATOLOGY

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Abstract book

I.O.F.O.S. CONGRESS 2013

Firenze, Italy, August, 29-31, 2013

EDITORIAL

The International Congress of IOFOS, organized by IOFOS and the Department of Health Sciences of the University of Florence, has been held in August, 29-31 at the Faculty of Medicine of the University of Firenze. More than 200 participants, coming from 40 countries, attended the 19 scientific sessions which were dedicated to all the areas of education, qualification and practice in forensic odontology. The scientific program was fostered by 118 presentations of researchers, forensic odontologists and forensic experts coming from all around the world. A piece of knowledge was built through the presentations of the latest advancements in the main areas of forensic odontology, followed by the extensive and deep discussions which characterized all the sessions. Thereby prominent opinions and different experiences have been shared and compared between the attendees and more than 140 authors and 39 chair people, included deans at Dental School, University professors, presidents and board members of national and international Associations of Forensic Odontology, chairs and heads of forensic odontology groups, sections or services of Interpol, national polices or military entities, judges, lawyers, experienced private practitioners. The Congress Abstract Book reports the abstracts of oral and poster presentations, grouped per main area so that in the first part the presentations that focused on the different education of FOd (forensic odontologist) are gathered from country to country and the qualification required in different fields of practice. Comparing qualification and accreditation of forensic odontologists in the numerous intervened countries, a serious step ahead was made towards internationally accepted standards in forensic odontology practice and a continuation of quality assurance process that IOFOS has been pursuing in the last decades. Contributions dealing with ethics, malpractice, litigation and insurance report extensive national experiences and offer highly qualified analysis in these areas. Meanwhile demonstrating Forensic Odontology and FOd activity cannot be deemed as limited to dental identification, being most FOds expert in dental ethics and medico-legal issues of dental practice. Body identification, age estimation and bite mark confirmed to be pillar topics of Forensic Odontology, for which the conference received, as expected, numerous, highly qualified presentations of the most active research groups as well as the most accredited and internationally renowned forensic odontologists. The latest advancements of dental methods, oral autopsy techniques and technologies experimented and presented demonstrate that the body identification procedure based on dental evidence, beyond its traditional importance, to be very active and ever more reliable and suitable in the daily forensic practice. Presentations dealing with age estimation for sub-adults, and especially those reporting results of studies based on very large and multiethnic samples, proved that consistent evidence is emerging in this field of forensic odontology. The legal and the ethical issues connected with age estimation in living subjects have been deepened and new methods for age estimation in adults have been proposed as well. Sessions dedicated to bite mark faced the most questioned aspects of this area of identification by dental means, being bite mark evidence no more admitted in some Courts or

resulted in contrast with other evidence (DNA, i.e.). An accurate selection of cases with significant evidentiary value, a scientific approach and the involvement of highly qualified and experienced forensic odontologists, emerged as crucial elements of this challenging field. Forensic odontologists affiliated with the IOFOS are regularly recruited during mass disasters where they take part in connection with Interpol DVI, international institutions or agencies, national and local governments, and military entities. Therefore they gain enduring and extensive experience in mass-disaster interventions. Some important lessons have been reported and learned through which the DVI procedure and the approach can be reviewed and implemented.

The participation to the conference of pathologists, legal-medicine specialists, lawyers, DNA experts, as well as connections with other prominent international associations officially intervened to the congress (IAFS, IALM and FOd Working Group of DVI Interpol) demonstrate that Forensic Odontology as a discipline, and IOFOS as a world organization, maintain strong and lively contacts with other forensic disciplines and organizations.

IOFOS represents the largest international community of forensic odontology and milestones have been set by looking toward new advancements and improvements in the future, thanks to highly qualified presentations and valuable experiences of forensic odontologists and experts intervened to the IOFOS Congress 2013.

Vilma Pinchi
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President of the IOFOS 2013 Congress

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Supplement
I.O.F.O.S. International Congress
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Abstract book IOFOS Conference 2013 Firenze

FORENSIC ODONTOLOGY'S MIGRATION FROM AN OCCUPATION WITH "HOBBY STATUS" TO A RECOGNIZED, REGISTERABLE SPECIALTY WITHIN DENTISTRY.

John Clement*

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The author declares to have no conflict of interest.

ABSTRACT

The past four decades has seen profound changes in Forensic Odontology. In the beginning when the embryonic specialty rested in the hands of a few practitioners in just a few countries, even the name was controversial with many different interpretations on the role and scope of responsibilities of the forensic odontologist. In the early 1970's the author was once congratulated by a very senior police officer on the foresight of the authorities to have a dentist available after a mass disaster just in case some of his investigators had toothache! Times have moved on. It is now clearly understood that after mass fatality events and provided that antemortem records exist, the benefits of deploying forensic odontologists provides a rapid, robust and relatively cheap means of identification. Whilst identification by comparison with existing dental records remains the main thrust of our work, other circumstances also draw upon the skills of a properly trained forensic odontologist. These include identification of the living, age estimations, analysis of wounds (especially bite marks), the replication of injuries, issues of causation of injuries, investigation of child and elder abuse and the trafficking of people into slavery

For these tasks to be undertaken competently and within a consistent framework of standards and fees, specialised courses of instruction had to come into being. In the mid-1980's in UK these courses were aimed at the experienced dental practitioner and therefore at the post-graduate mature-student level leading to a graduate diploma. The courses proved to be very successful and the emergence of dentists with some specialist knowledge then spawned the birth of the British Association for Forensic Odontology about 30 years ago. This coincided with similar developments elsewhere in the English-speaking world and standards were inevitably raised.

Numerous mass-fatality events of the past two decades have thrust forensic odontology to prominence and this has led to comparisons with other specialties such as forensic pathology in which the training has been much longer and knowledge examined more rigorously. Furthermore the deployment by some national authorities of dentists in their employ to assist with DVI has occasionally led to difficulties for both the inexperienced practitioner who has been sent, and the more seasoned DVI dental experts. In

Australia this has led to minimum standards of training and experience being defined as prerequisites to any deployment to mass-casualty events. We have so far avoided the thorny issue of credentialing but

FORENSIC ODONTOLOGY'S MIGRATION FROM AN OCCUPATION WITH "HOBBY STATUS" TO A RECOGNIZED, REGISTERABLE SPECIALTY WITHIN DENTISTRY **John Clement** .

vigorous activity from Aus FOd members has resulted in core curricula being developed, training pathways through universities and the Royal College of Pathologists of Australasia being drawn up and stipends for training positions becoming available. The transformation of forensic odontology from an occupation with "hobby" status to that of a well-recognized micro specialty within dentistry has been recognized by both the RCPA who have recently awarded Foundation Fellowships to leading practitioners under a "grandfather" arrangement and the Australian Health Professionals Registration Authority (AHPRA). Details of this transformation and the pitfalls encountered will be given at the meeting.

***KEYWORDS*:** Forensic Odontology, Recognition, Speciality.

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FORENSIC DENTISTRY AT THE UNIVERSITY OF ZAGREB

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[1]Member of the IOFOS Board - Dean of the School of Dental Medicine of the University of Zagreb. He has actively participated in several international conferences and published more than 100 scientific and professional publications, books and book chapters. He is also a member of several international editorial boards and, since 2006, he has been the editor in chief of the Journal Acta Stomatologica Croatica.
The authors declare that they have no conflict of interest.

ABSTRACT

The Forensic Dentistry in Croatia, according to the written data, started in 1934 when two legal experts were hired to solve a case of a patient that died after dental treatment. Between 1971 and 1991 there were a few mass disasters in Croatia in which the identification of the victims did not include local dentists. An exception was a railroad accident in Zagreb, 1974 when the first dentist was included in the identification process, but without any prior education. The war in Croatia (1991-1995) brought the need for victim identification from mass graves. DVI teams and forensic laboratories were founded in Zagreb, Split and Osijek. Zagreb identification team included an educated forensic dentist from the School of Dental Medicine University of Zagreb. Numerous dental identification cases, naturally, brought the will and the need for further investigation of new techniques, skills and scientific methods. As a result of these, a single-semester course was introduced at the University of Zagreb, with 15 hours of lectures and 15 hours of practical training during the 5th year of Dental Medicine. The Chair for Forensic Dentistry was founded in 1997 at the Department of Dental Anthropology, the same year the undergraduate education started, and in 2000 a university textbook Forensic Dentistry was published. The School of Dental Medicine University of Sarajevo introduces the course, and in the last 12 years our lecturers are frequent guests at the University of Ljubljana, Slovenia. Apart from the professional help for the colleagues at the Department of Forensic Medicine, the staff develops this area scientifically by presenting their work on international meetings and by publishing their articles in forensic journals, but also through the Croatian Forensic Dental Association. The development of Croatian forensic dentistry has greatly been helped by the cooperation with other forensics from all over the world that has supported our work and has strived to achieve the recognizability of Croatian forensic dentistry in the world. Zagreb School of Dental Medicine is the only school in the Western Balkans that has the Chair for Forensic Dentistry and that actively educates dentists in this field in the undergraduate and postgraduate education, including the continuous education.

***KEYWORDS*:** Forensic Odontology, Education, Croatia.

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PROFILE OF A TERRORIST, ANDERS BEHRING BREIVIK. EFFECT ON THE NORWEGIAN SOCIETY AND THE POLICE FORCE

Tore Solheim*, Sigrid I. Kvaal

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The authors declare that they have no conflict of interest.

On 22nd July 2011 a large bomb exploded in Oslo killing 8 people and causing considerable damage to government buildings. Later the same evening a gunman went to the island of "Utøya" where the Workers' Youth League, the youth movement of the Labour party, had their annual summer camp. He shot and killed 69 people on the island. The terror attack was made by only one man; Anders Behring Breivik, born in Oslo in 1979. He was thus 32 years at time of his terror action. His parents divorced the year after he was born and Anders lived with his mother. In 1983 the Child Welfare Service in Norway in a report concluded that he ought to be removed from his mother. He was an intelligent boy, but from 1995 he lost contact with his friends and isolated himself. He used the Internet and played war games on his computer. For several years he made preparations for the attack. He found out how to make a bomb using fertilizer. He hired a farm so that he could justify the purchase of fertilizer and to be able to work on the construction of the bomb undisturbed. He imported 5 tons of fertilizer and constructed the bomb and made test bombs to be sure it worked. Anders Behring Breivik had a political ideology behind his terror. He was a right wing extremist and anti muslims. He said after his arrest that he belonged to the Knights Templar and he would save Western Europe from Islam. His action was the beginning of a revolution in Western Europe. The reason for the terror was that he wanted to hit the Norwegian Labour Party which he thought was responsible for decay of the Norwegian society and the influx of Islam.

The attack was carried out with military precision. After the attack the police did not find any evidence that more than one person was involved or that the Knights Templar existed. As Brevik admitted guilty to the terror attack and shooting, the main issue for the court was whether he could be regarded responsible for his actions and sentenced to imprisonment. Two psychiatric commissions arrived at opposing conclusions; one that he was diagnosed with paranoid schizophrenia and the other that he had antisocial and a narcissistic personality disorder, but not schizophrenia. The court verdict was that he was sane and he was sentenced to containment; a special form of a prison

sentence that can be extended indefinitely—with a time frame of 21 years and a minimum time of 10 years, the maximum penalty in Norway .
The attack on the government building and shooting at Utøya had a profound effect on both the police force and the whole of the Norwegian society. The question has been raised several times: "Did the police force handle the attacks as quickly and efficiently as one might expect? This will be discussed. The Parliament and Government and the Norwegian society at large have questioned if the attacks could have been prevented or the effects been reduced? The Prime Minister said all facts should be put on the table. A governmental Commission severely criticized both the police force and the Government's lack of preventative actions. The terror attack and what has been done afterwards is still discussed almost daily in the media.

***KEYWORDS*:** Forensic Odontology, Terrorist profile, Norway**.**

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IDENTIFICATION AFTER TERROR ATTACK IN NORWAY 2011

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The author declares to have no conflict of interest.

ABSTRACT

Background: On Friday afternoon 22nd July 2011 was a 90 kg bomb detonated in Oslo causing severe structural damage to government buildings. The bomb-man then drove x km to "Utøya", a small island on a lake where the youth movement of the Labour party held their annual summer camp. On arrival dressed in a home made police uniform he immediately shot two adults and then went round the island shooting, killing and injuring youngsters who were trying to hide from the gunman. The Norwegian ID-group were immediately mobilized and the following morning the post mortem examinations started. A standard forensic odontology examination was carried out which in addition to an oral examination included digital radiographs and photographs. The results were registered in the DVI-system.

The aim of the presentation is to look at the dental findings and see if forensic odontology can be of use in an accident involving youngster from a supposedly caries free generation.

Material and methods: The dental status of the victims was registered with regard to dental restoration, missing teeth, orthodontic appliances, retained deciduous teeth and other dental characteristics that could be used for dental identification.

Results: Eight people were killed at the Government buildings. They were all adults and not included in this review. At the campsite 68 were shot and killed and 1 died the following day in hospital. Of the 68 victims 7 were older than 25 years and the two youngest were only 14 years. The average age was 18 years. Only 9 victims had no fillings and 55 had composite fillings ranging from 1 to 15. Eleven of the victims had an orthodontic retainer after completed treatment and only one had a fix orthodontic appliance. Five victims had one retained deciduous tooth and one victim had two deciduous molars. Identification comparing filling position and contours on radiographs provided sufficient material for making a strong contribution to the final identification.

Conclusion: In a group of young victims forensic odontology can demonstrate characteristics sufficient for identification provided that material is available for comparison.

***KEYWORDS*:** Forensic Odontology, Terror Attack, Oslo.

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MAPPING FORENSIC ODONTOLOGY: A RESEARCH PROJECT OF I.O.F.O.S.

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The author declares to have no conflict of interest.

Given the lack of extensive and update information about Forensic Odontology (FO) practice in the different nations and world areas , IOFOS is actually promoting an interview through a special questionnaire sent to the Presidents of National Forensic Odontology Associations and Societies where they exist. In Countries that have not yet established FO Association has been yet established active forensic odontologists (Fod) have been contacted to retrieve data.
The questionnaire provides an introduction where the preliminary issue of definition of FO is dealt with, since in many countries FO is extended to include ethics in dentistry, dental litigation, dental damage evaluation and ethics in dentistry.
The first section of the questionnaire is specifically dedicated to gather data about education of Fod both in undergraduate – postgraduate courses and the qualification of professors who teach FO.
The second block of questions concerns the qualification and accreditation of Fod and some questions are addressed to focus on the requirements imposed by law or considered by Institutions/Agencies/judges to entrust a Fod along with the qualification control that National FO associations have on their members.
The third part of the questionnaire deepens the practice of FO in different countries referring to the number of active Fods, the existence of DVI team and the involvement of Fod, the relevance of dental evidence as preferred/neglected primer identifier and the occurrence of Fod negligence cases.
The last section of questions are addressed to outline the circulation of FO knowledge at national level, the connection of FO national societies/associations, the concerns about editorial space and journals dedicated to FO research. An opinion about possible improvements of FO situation trough specific measures (increasing founds, providing qualification standards, etc) are asked to the compiling person.
The preliminary results of the survey will be discussed along with the future development of the research.

***KEYWORDS*:** Forensic Odontology, Qualification, Practice.

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ARE YOU READY TO BE AN EXPERT WITNESS?

Haskell M. Pitluck*

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The author declares to have no conflict of interest.

ABSTRACT

Background: There is a distinct possibility that a professional who examines evidence in a legal action may have to testify in court to explain his or her work, as well as the conclusions reached and the reasons for doing so. Expert witnesses often are the most important aspect of a trial. Thus, an expert needs to be prepared for everything encountered in a courtroom.

Issues with expert testimony: The expertise of the professional in a court of law will be seen in a different light from the work environment when that professional testifies in court.

An individual might be one of the most accomplished scientists and /or experts in his or her field, but if that person can not explain his or her conclusions when testifying, the expertise might be ineffective. A well prepared expert witness can greatly assist the legal process.

Conclusion: This presentation will help familiarize the expert to become an asset in the legal system to best present the expert's conclusions. How to prepare for testifying is a crucial skill. If the expert is aware of what lawyers, judges and juries are looking for from the expert, the expert is able to be a successful witness in court.

***KEYWORDS*:** Forensic Odontology, Expert Witness, Preparedness.

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FORENSIC ODONTOLOGY IN BRAZIL: DENTAL EDUCATION, PROFESSIONALS AND ACTIVITIES

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The author declares to have no conflict of interest.

ABSTRACT

In Brazil, Forensic Odontology is one of the 19 different specialties recognized by the Brazilian Federal Council of Dentistry and, as competencies, the dentists related to the Forensic Odontology work in different fields, such as human identification, DVI, bitemark, dental damage evaluation, age estimation, ethics in dentistry, dental malpractice litigation, labour expertise, and others. This presentation aims to show the different career options available for forensic odontologists in Brazil, as well as, the number of practicing professionals and the importance of Forensic Odontology for the Brazilian society and justice.

***KEYWORDS*:** Forensic Odontology, Career Options, Brazil.

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COMPETENCIES IN DENTAL ANATOMY AMONG ODONTOLOGISTS

Jane Taylor*, Russell Lain, Richard Kemp .

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The authors declare that they have no conflict of interest.

***Background**: Frequently examination of the teeth and jaw of deceased persons is relatively straightforward with the teeth intact and contained within the alveolar bone. On other occasions the teeth may be separated from the alveolar bone and may or may not be fractured. Depending on the circumstances of the disaster these fragments may also be incinerated. Identification of individual teeth independent of associated alveolar bone can be difficult, and combined fracture or incineration can magnify this difficulty. Comingling with animal remains and teeth may add an additional confounder to the identification of individual teeth.*

This study reports on competency in dental anatomy using visual (photographic) and tactile methods of assessment. Participants with varying levels of experience in forensic odontology participated in one of 3 workshops in dental anatomy. All teeth used had been collected under ethical approval and were of known provenance, or were acrylic replicas of these teeth.

***Method**: Simple demographic data were collected from participants including age, qualifications and experience in forensic odontology. All participants were dentists, most with varying levels of experience in forensic odontology.Each workshop consisted of 4 exercises in identification of teeth: (1) Photographic; (2) Tactile – intact teeth with or without restorations; (3) Tactile – fragmented, grossly carious and/or incinerated teeth; (4) Tactile – many teeth from the same individual. Participants were asked to identify each tooth and to rate the confidence of their decisions. The time allowed for each identification was capped. Participants were encouraged to refer to a dental anatomy textbook.*

***Results:** Results showed that visual and tactile methods produced similar results. There was no correlation between years of experience and performance. There was no difference in score between participants with increased anatomical knowledge and those without. Participants with extensive experience in forensic odontology performed better.*

***Conclusion:** These exercises confirm that identification of individual teeth is difficult. This reinforces that the tasks of forensic odontology are difficult and that high level skills in dental anatomy are required. The results also highlight the need for forensic odontologists to maintain skills in dental anatomy through continued professional development and training*

KEYWORDS: Forensic Odontology, Identification, Dental Anatomy.

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THE NOTION OF SAMPLE, THE LIMITS OF RIGHTS AND ETHICS

Didier Cerino*, Claude Laborier, Christophe Rallon, Philippe Welsch.

*A.F.I.O. – Association Francaise d'Identification Odontologique

The authors declare that they have no conflict of interest.

Where can the ethics be found in this question ? Does a carbonized and dismembered body has an identity? The face does not wear the privilege of the identity. What can be thought of the faces transplants ? The problem exposed (explained) by the authors is: the reconstruction of the face and the jaws taken in the autopsy in the context of the identification of the persons
Questioning:
1) The expert obeys the directives of the judge within the framework of his mission or of his requisition.
The mission stipulates to practice all the necessary takings.
2) When the state of the body is putrefied, carbonized, split, the taking of jaws is compulsory.
When the body is fresh and deformed with accessible jaws, the problem of taking can settle. The mission of the expert that must be respected, however the ethics were early on the right (law), we can ask in certain cases the question of the taking jaws under condition that it does not perturb the identification of the person.
3) The techniques of takings are simple, the reconstruction is simple but the question everybody is asking is to know who is going to pay?

4) The position of Interpol

***KEYWORDS*:** Forensic Odontology, Identification, Rights and Ethics.

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SEQUELAE OF TORTURE DIRECTED TOWARDS THE ORO-FACIAL REGION MAY BE DIFFICULT TO EVALUATE - CLINICAL FORENSIC ODONTOLOGICAL EXAMINATIONS OF ALLEGED TORTURE VICTIMS AT THE UNIVERSITY OF COPENHAGEN 1997-2011.

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The authors declare that they have no conflict of interest.

Background: ***Clinical forensic examinations of alleged torture victims have been performed by forensic pathologists at the University of Copenhagen since1995. In 13,2%/33 of these cases the examinations were supplemented by a forensic odontological clinical examination. In this study the forensic odontological cases from the years 1997-2011 are presented and discussed.***
Methods: ***This study includes 33 reports from alleged torture victims (4 females, 29 males) who have been examined by a forensic odontologist at the Copenhagen School of Dentistry in the years 1997-2011.The material available consisted of copies of medical forensic reports and the forensic odontological reports including x-rays. Background data, anamnestic data and results of the forensic odontological clinical examinations were registered as well as the conclusion of the clinical examinations.***
Findings: ***The forensic odontological clinical examinations were complicated by the presence of unspecific injuries and various degrees of active oral pathology. In 27 of the cases it was concluded that the findings were consistent with the alleged torture, in six of the cases the findings were concluded to be highly consistent with the alleged torture.***

***KEYWORDS*:** Forensic Odontology, Torture, Copenhagen.

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AN ETHICAL VIEW OF ADDICTION AND RESTORATIVE JUSTICE

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The author declares to have no conflict of interest.

Addictions and ethics are complex. As information increases about both additional sets of ethical decisions are being raised. The underlying ethics of addictions however is rarely explored. This paper aims to re-present a brief interactive session offered to the IDEALS Congress in Leuven. If addictions, on one hand, are sometimes considered "bad habits," then ethics/morality, on the other, can also be understood as virtues or "good habits."
Ethics as an actual intervention tool - and not limited simply to ways of clarifying which of the traditional and newer interventions should be used under various circumstances – may need, then, more focused deliberations. The bases for this presentation was first introduced through a three part series in a regular AGD Impact column – a newsmagazine for American general dentists.[1,2,3]
It is my expectation that introducing this notion to an international audience might confirm some of Dr. Ozar's and my basic suppositions about treating patients with addictions and, perhaps, generate new insights into the ethics of addiction interventions – especially under the theme of restorative justice. Key to this discussion is a notion that addiction involves patients who are both fully capable yet, at the same time, also fully incapable regarding a specific matter at hand. Another notion regards our understanding of stigma and that addictions are both a personal and a public health issue. Based on a case presentation, these notions are further explored within the context of the individual Chairside doctor patient relationship and demonstrate that to begin addressing this complex issue, accurate clinical and ethical diagnoses must be established if the dentist wishes to maintain a professional ethics relationship with the patient and society.

***KEYWORDS*:** Forensic Odontology, Ethics, Addiction.

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ALTERNATIVE DISPUTE RESOLUTION - NEW LAW IN CASE OF A MEDICAL ACCIDENT DURING TREATMENT

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The author declares to have no conflict of interest.

The Law of March, 31, 2010 about compensation for accidents during medical treatment was the result a long discussion in the Belgian parliament. A Fund of Medical Accidents was established. What are the advantages? It is beneficial to all parties (Victim, practitioner, insurance company)
The burden of proof is easier for the patient because the Fund will collect all relevant documents. It will protect also the practitioner because there will be no negative publicity or a damaged reputation. The entire procedure is gratis.
It is a to-way system because the Victim can make a choice between a Court procedure or this Law. The decision of the Fund is only a motivated advice and not binding. The procedure should be finished within 6 months. It includes also a possibility to get a "no fault" compensation if certain conditions are fulfilled. It may become the preferred procedure in the future for medical accidents

***KEYWORDS*:** Forensic Odontology, Alternative Dispute resolution, Dental treatment.

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PROFESSIONAL LIABILITY INSURANCE IN FORENSIC ODONTOLOGY IN THE U.S.

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The authors declare that they have no conflict of interest.

A Most dental professional liability insurance policies in the U.S. do not cover dental professional services solely in the performance of providing forensic odontology and expert witness services to others for a fee. It is also known that cases of liability related to forensic findings that were eventually proven to be erroneous have been brought to trial by the indicated suspects attempting to be awarded monetary damages claimed by the individual.

To investigate the general knowledge, perception and interest in such malpractice coverage among forensic practitioners, two confidential online surveys related to liability coverage directly related to forensic odontology were submitted to the members of two forensic organizations. The first dataset represented the American Society of Forensic Odontology (ASFO) and the second dataset was obtained from the American Board of Forensic Odontology (ABFO). There was a response rate of N=148 for the ASFO group and N=30 for the ABFO group.

Participants were first asked to state the annual income garnered from their practice solely based on forensic odontology. The respondents from the ASFO group indicated that 73.7 percent earned equal to or less than $10,000.00 per year with 35.8 percent earning $0 to $1,000.00 dollars per year. For the ABFO group, the percentage was 43.3 percent for $10,000.00 or less with only 6.7 percent earning less than $1,000.00 per year. Also, 46.6 percent of the ABFO group earned between $10,000.00 - $50,000.00 annually while with the ASFO group, the percentage was 22.3 percent.

Participants were also queried as to whether their current dental malpractice insurance policy would cover claims against them regarding forensic expert reporting and expert witness testimony. In both groups, the responses were statistically equal in the following survey responses: "yes", "no", and "I don't know". However, the largest percentage was in the ASFO group with 44.9% responding "I don't know". When participants were asked if they would be interested in purchasing a 'hold harmless' forensic malpractice insurance plan, 69.6 percent of the ASFO group responded in the affirmative while the ABFO positive response was 83.3 percent. Also, when asked what the 'outward limit' of the policy should be, 48 percent of the ASFO group chose $1,000,000.00 while 63.3 percent of the ABFO selected that same amount of coverage.

Based on the data that were recovered in this survey, the ASFO leadership negotiated a forensic odontology liability policy with a choice of two levels of 'outward limits' at a substantial discount exclusively for its membership.

***KEYWORDS*:** Forensic Odontology, Alternative Dispute Resolution, USA.

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DENTAL LITIGATION CLAIMS OF THE LARGEST PUBLIC DENTAL SERVICE IN ITALY OVER THE LAST FIVE YEARS

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The authors declare that they have no conflict of interest.

Background: *The analysis of dental litigation provide several information about dental service, dental disciplines at higher risk of claim, dentist -patient relationship, etc. Anecdotically, dental litigation is deemed progressively increasing, but recent data do not support such a common opinion. Analysis of dental claims help hospitals and dental health professionals to improve the assistance, general organization of the service, procedure of management and government.*
The aim of this study is to examine litigation in dentistry of the biggest public service in Italy, over a period of five years (from 2008 to 2012).
Materials and methods: *The paper is based on the medico-legal analysis of 239 reports of dental litigation. Reports, written by a dentist expert in legal medicine, are examined according to predetermined criteria: 1) gender and age of dentist and of patient 2) involved discipline 3) latency period between treatment and claim filing 4) complained damage 5) average costs of compensation 6) unsettled claims and court prosecution.*
Results: *will be discussed and compared with those published nationally and internationally. Comparing findings with data published by Manca (2011) and Pinchi et Al (2013), the differences of dental litigation arising from National Health Services and private practice can be discussed.*
Conclusion: *Our data of dental claims are consistent with those reported by different authors for dental discipline prevalence. Out-of-court settlement shows high rate of success in solving dental dispute when a dentist expert in legal- medicine and in conciliation procedure is involved.*

***KEYWORDS*:** Forensic Odontology, Dental Litigation, Italy

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COMPARISON OF THE DIAGNOSTIC ACCURACY OF CBCTs AND OPGs: CLINICAL AND MEDICO-LEGAL ISSUES

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The authors declare that they have no conflict of interest.

***Background**: Since a long time the OPG is the most widespread and prescribed radiological examination. The introduction of the digital imaging has allowed the reduction of the exposition dose to x rays and an important improvement of the quality of the images. Moreover, some three-dimensional radiological examinations are becoming ever more used in the dental diagnostic routine since they are relatively inexpensive and easy accessible and provide accurate examination. Particularly a CBCT scan allows to accurately detect site and dimension of oral pathological conditions which the OPGs, on the contrary, cannot definitely recognize and implies very low radiation dose respect to traditional CT. Given that, the CBCT scan may become a recommended procedure in specific clinic conditions and the omitted prescription may raise medico-legal and ethical issues.*

The aim of the present study is to evaluate the different diagnostic accuracy of CBCT compared with that proper to a digital OPG.

***Materials and methods**: 100 OPGs and CBCTs (a total of 200 upper and lower dental arches) were selected for the study, performed for ordinary clinical purposes in the same day, in the same radiology office and with the same devices, have been submitted for the comparison to 3 general dentists. The operators examined first the OPGs and after 1 week the CBCTs , and listed in details every detectable oral alterations (transparencies, opacities, etc).. The difference in diagnostic accuracy between the two exams has been evaluated. The intra-operator variability has also been evaluated re-submitting the 10% of the exams to the operators after two weeks. The inter-operator variability is also evaluated.*

***Results:** Even if the research is still in progress, it is already clear that the CBCT exam allows to obtain a more accurate diagnostic evaluation of the oral clinical conditions than the OPG exam does. The CBCT particularly allows to reveal more precisely the site and the actual dimensions of the pathological processes of the maxillary bones only poorly or not detectable at all by the OPG. In most samples at least one lesion not revealed by OPG is showed by CBCT , especially for periapical radiotrasparencies of endodontically treated teeth. The most striking cases will be described and discussed. Hence the ethical as well as the medico-legal implications will be discussed in terms of appropriateness of two different radiological examinations, given their radiation dose, the costs and the difference in efficacy in specific diagnostic procedures.*

Conclusion: ***The preliminary results of our study show the evidence of the greater value of the CBCTs in the diagnostic resolution in comparison to the OPGs. The drastic reduction of the dose of exposition to x-rays permitted by the most recent radiographic devices, and the reduction in the cost of the single examination, put even further the CBCT in a prominent position in some clinic circumstances. The connected medico-legal issues deserve discussion in terms of appropriateness of the different radiological approaches and for the possible implications in terms of standard of care.***

KEYWORDS**:** Forensic Odontology, Diagnostic Accuracy, CBCT and OPG.

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ERGONOMICS OF INFORMED CONSENT

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The authors declare that they have no conflict of interest.

The proper setting in communicating with the patient is critical to most of usual patient-physician relationship, but is of utmost importance in dentistry.
In fact, due to the sometimes hypertechnical environment that obviously reminds the patient of the operative structures of surgical units (even the most dentist-oriented ergonomic chairs), it is reasonable that the average subject might be psychologically conditioned with varying degrees of anxiety and proportionate impairment of clear mental representation of the items of information.
While delegating to a close-future work the statistical demonstration of the amount of bias in understanding information due to different settings, by the way of a model based on checking the amount of actual understanding and memorizing by patients to whom a bulk of data may be given in different locations in the dental practice, we now suggest to deliver the patients with the most delicate material in terms of informed consent not while s/he is sitting on the dental chair but – if feasible - in the secretary room or - even better – right in the physician's office.

***KEYWORDS*:** Forensic Odontology, Informed Consent, Ergonomics

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A LETHAL CASE OF LUDWIG'S ANGINA

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The authors declare that they have no conflict of interest.

Background: ***Life-threatening odontogenic infections are very rare. However, untreated periapical infections especially in the lower molar regions may spread to the submandibular space and via parapharyngeal spatia to adjacent structures. The condition may progress very rapidly. The cellulitis is called Ludwig`s angina and may have lethal consequences mainly due to airway obstruction. Case history: A 25 year old male addressed a private dental practice for emergency treatment on a Saturday outside opening hours. According to the dental record he presented with fewer, moderate extraoral swelling, several carious lesions and heavy pain from a major lesion in 37. The dentist prescribed antibiotics and instructed the patient to seek hospital emergency treatment if signs of dysphagia or compromised airways developed over the weekend. An appointment with the regular dentist should be arranged the following week. It was stressed that the patient should not be let alone. The situation seemed to improve the following days where the pain abated. However, on Tuesday the patient was let alone at 07.00 and at 12.30 he was found unconscious. The head and upper truncus was bluish, the submandibular region and tongue were characterized by heavy swellings. Resuscitation was unsuccessful.***
Methods / Results: ***Autopsy including forensic dental examination revealed extensive extra- and intraoral swellings and visible accumulations of pus in the oral cavity. Clinical and radiographic dental examination showed several major carious lesions in maxillary and mandibular teeth. A slight widening of the apical periodontal membrane was seen in 26 and 37 but no major radiolucent areas could be observed. By thorough clinical examination an approximately 1 cm^2 area characterized by several microscopic perforations of the cortical bone was found at the lingual aspect of the mandibular base adjacent to the apices of 37. Spread of infection with major accumulations of pus in relation to mediastinal structures, lungs and anterior aspect of the vertebral column were found. Microbiological analyses showed that the microflora was dominated by streptococci and staphylococci. It was concluded that airway obstruction due to sepsis with swellings of the floor of the mouth and infection spread into neighboring areas was the cause of death. The case emphasizes that patients with general symptoms as fewer and swellings of the floor of the mouth and neck should be very carefully followed. Signs of airway obstruction is a serious warning of infection spread. Ludwig`s angina may furthermore be characterized by significant edema causing trismus and inability to swallow saliva.***

Conclusion: ***Dentists and general doctors must be aware of even subtle signs which occasionally may develop into a life-threatening situation where referral to hospital for intravenous administration of antibiotics and in severe cases tracheostomy is the only way to secure airway control. Further, this severe case should remind forensic pathologists and forensic odontologists about the possibility of a dentaI origin for general infections also in less obvious cases where the indications of a dental involvement are more subtle.***

KEYWORDS**:** Forensic Odontology, Ludwig's Angina,Lethal.

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LEGAL EFFICIENCY OF DENTAL IMPLANTS

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The author declares to have no conflict of interest.

Prosthetic efficiency of dental implantology is nowadays almost universally accepted. The relevance of injury to a dental implant prosthesis, compared to similar injuries occurring to natural teeth is considered in both the fields of damage compensation and criminal law.
Even if undoubtedly prosthetic, the criminal relevance of damage to a dental implant must be considered precisely identical to injury to an analogue natural element. Differences may ensue in the field of damage compensation, where only the fees due to proper restoration become of interest, with minimal - if any - relevance on personal physical impairment.

***KEYWORDS*:** Forensic Odontology, Legal Efficiency, Detal Implant

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UNITED STATES DENTAL EDUCATION DEBT LOAD AND THE IMPACT ON DENTAL ETHICS AND PRACTICE LIABILITY

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The authors declare that they have no conflict of interest.

The severe increase in the expense of dental education in the United States is having an effect on the dental profession. The resultant increase in concomitant debt load appears to be having an impact on the frequency of certain types of dental malpractice claims within new to practice dental graduates. Additionally, this debt load appears to be contributing to a shift in the practice platform that new to practice dental practitioners are pursuing. Claims data appears to be reflecting that new to practice graduates:

1. ***may be influenced into overtreatment planning patients***
2. ***are practicing beyond their level of experience and competence***
3. ***are engaging in practices for which they may have had little or no formal training***
4. ***have decreased the amount of referrals to specialty practitioners, specifically Oral and Maxillofacial Surgeons and Endodontists***
5. ***are engaging in marketing practices such as sleep dentistry and sedation and peri-cosmetic techniques.***
6. ***are engaging in financial and credit practices which may increase exposure to the practice,***
7. ***are increasing the expanding segment of practice involving dental implants***

These claims trends will be discussed as well as the potential impact of debt load concerns on the professionalism and ethical practice in new to practice dental graduates.

***KEYWORDS*:** Forensic Odontology, Ethics, Liability.

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CIVIL LIABILITY OF DENTIST: PROFESSIONAL'S KNOWLEDGE AND ANALYSIS OF LEGAL PROCEEDINGS

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The authors declare that they have no conflict of interest.

***A Background:** Issues concerning dentist's liability have gained importance nowadays and there has been an increase in the number of conflicts between professionals and their patients, related to the received dental treatment. The aim of this study was to investigate the lawsuits involving civil liabilities filed against dentists in the Ribeirão Preto Court, SP, Brazil and analyze the local dentists' knowledge of civil liability and means of protection.*
***Methods:** A list of dentists and dental clinics registered in the city was requested from the Regional Council of Dentistry. A nominal search of professionals and clinics involved in civil lawsuits was performed using the online database of the São Paulo State Court. This search resulted in 145 cases, which were subsequently analyzed directly at the Court regarding their relationship to professional liability. In the second stage of the study, 100 dentists were randomly selected from the list of professionals registered in the Regional Council of Dentistry and were asked to answer a questionnaire containing 19 questions.*
***Results:** From 145 cases retrieved from the online search, 45 cases involved dentist's civil liability and were included as of relevant interest for the present study. Out of these, 33.3% had already been solved. It was observed a significant increase in the number of lawsuits in the past five years, most of them involving the areas of dental prosthesis (35.6%) and implantology (26.6%). Expert dental examination was requested in 33.3% of cases. Based on the analysis of the questionnaire, all professionals consider important the knowledge of their responsibility in dental practice and 94% have heard about this subject. Regarding the type of obligation assumed by the professionals, 28% believe that the dentist should ensure results, 28% believe they do not, and 44% related the assurance of results to the dental field. Regarding the increase in the number of civil lawsuits against dentists, 79% are aware of this fact and 57% know at least one case of prosecution. Moreover, 41% of the professionals revealed to be unsure in dental practice. In this search about means of protection, 72% know about civil liability insurance, 45% use this kind of insurance and 82% would feel safe if hired this type of protection.*

***Conclusion**: There was an increase in the number of civil liability cases against dentists in the city Ribeirão Preto, SP, Brazil. Furthermore, dentists are concerned about the issues involving civil liability, but there still are divergences among the professionals about the nature of their duty in exercising dental*

***KEYWORDS*:** Forensic Odontology, Diagnostic Accuracy, CBCT and OPG.

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DENTAL TORTURE: A CASE STUDY

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The author declares to have no conflict of interest.

Throughout the world people may be held in detention for their religious or political beliefs. While in detention some detainees may be subject to torture.
A case study that reports on a recent incident of dental torture will be presented.

***KEYWORDS*:** Forensic Odontology, Torture, Case Study

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MEDICO-LEGAL ASPECTS OF FORENSIC ODONTOLOGY IN CZECH REPUBLIC

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The author declares to have no conflict of interest.

***Background**: Since a long time the OPG is the most widespread and prescribed radiological Forensic odontology is a branch of medicine which is significantly involved in dealing with issues related to the assessment and evaluation of the severity of the injury in the orofacial area, mechanism of injury, the resolution of complaints on the suitability or the incorrectness of the treatment, identification of unknown persons, analysis of bitemarks and cooperation with government in the case of mass disaster. The basic medico-legal aspects of forensic dentistry in the Czech Republic are explained in the examples of the author's activities as an expert witness in the field of forensic medicine and forensic odontology.*

For this activity there are several laws in the Czech Republic that the position of the doctor as an expert edits and which has been revised in the last 5 years. The basic legislative instrument applicable to expert activities in the Czech Republic is the Law on the Experts and Translators. It regulates who is authorized and under what circumstances expert opinions are provided. Expert opinion is one of the main evidence in the investigation of accidents in the preliminary criminal proceedings.

Comparison of the data given by the offender, victim and witnesses with the clinical findings, based on knowledge of biomechanics of injury of the orofacial system, clarify the accident process, because quite frequently it happens that the offender refuses to give testimony at all, or knowingly denies knowledge of plot, to avoid criminal prosecution. Case reports, where special knowledge from odontology was an essential part of the criminal and civil legal proceedings, are brought in. Medico-legal expert witness expresses his opinion on the severity of the injury to health disorders and its duration. These two indicators have a significant effect on the legal classification of the injury and the amount of the penalty for the committed violence. Another law act that applies to the qualifications of the severity of the injury in terms of a judicial-medical, is the Penal Code. In criminal proceedings three situations of health disorders may occur (minute injury, bodily harm and grievous bodily harm) according to which the injury is classified and if injuries is rated as some of the last two, the Court awards the penalty.

As far as civil proceedings, most frequently cases for injury (pain) compensation and disability are solved. Increasing number of cases of complaints about the procedure for the provision of dental care can be registered in the recent years. While compensation for injury (pain) and disability is usually performed and assessed by treating doctor according to Edict on Compensation of Injury and Disability, cases of complaints on mal treatment are solved by expert witnesses.

Last but not least is glorious application of forensic odontology in the identification of unknown persons. A wide range of methods is used to support the identification i.e. estimation of age, registration of dental health and markants for comparison AM and PM data. Forensic dentistry along with fingerprints and DNA profiling constitutes an essential set of identification methods. However, as well as other identification methods, it is limited by the availability of dental records to compare. The biggest advantage, however, is that the dental records in the Czech Republic must be kept for at least 10 years after the death of the patient. So, comparison of findings of the AM and PM is a fast and efficient method of identification.

***KEYWORDS*:** Forensic Odontology, Medico-Legal Aspects, Czech Republic.

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IDENTIFICATION OF HUMAN TRAFFICKING VICTIMS IN DENTAL CARE SETTINGS

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The author declares to have no conflict of interest.

Trafficking in human beings (THB) is a modern form of slavery and is a well-known phenomenon throughout the European Union and beyond. After drug dealing and the weapons industry, human trafficking is the second largest criminal activity in the world today and it is a growing crime. Italy is a destination or transit country for men women and children who are subjected to force, fraud or coercion for the purpose of sexual exploitation or forced labor. The aim of governmental and non-governmental agencies (NGAs), which are either directly or indirectly involved in combating trafficking in human beings, is the identification and referral of victims of trafficking and also to encourage self referrals. Identification is the most important step to provide protection and assistance to victims of trafficking. Victims of human trafficking often have a variety of physical and mental health needs including psychological trauma, injuries from violence, head and neck trauma, sexually transmitted infections and other gynecological problems, dental/oral problems and have poor nutrition. Healthcare and dental settings may offer opportunities for the identification of trafficked victims.

The author's experience in the field of community dentistry in presented within. Volunteer dental services are offered to non-EU patients held in a centre for asylum seekers (CARA) (Centro Accoglienza Richiedenti Asilo) in Bari (Italy). Dental professionals and forensic odontologists can in fact, contribute to the identification, assistance and protection of trafficked persons, as well as offering forensic services to assist the police investigation in order to identify crimes and find the criminal organizations behind them.

In domestic violence and child abuse cases, there are ethical concerns involved in the identification and protection of the trafficked persons, and the need for interdisciplinary work between law enforcement officers, social care providers and health and forensic professionals. The author recommends adequate training be given in behavioral sciences and also an awareness of the cultural differences present in victims which may have a bearing on how the case is handled.

***KEYWORDS*:** Forensic Odontology, Human Trafficking, Dental Care Setting

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MISSING AND UNIDENTIFIED PERSONS: IMPLICATIONS FOR HUMAN RIGHTS AND FORENSIC ODONTOLOGY

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The author declares to have no conflict of interest.

The non-profit making Association 'Penelope' created in 2002 with the purpose of pursuing social solidarity, people and dignity, focuses attention on the issue of missing people. With expert help it supports families by organizing conferences and publishing information, aiming to raise public awareness so that missing people are not forgotten. Among the aims of the organization is that of the promotion of suitable instrumentation for the collection and elaboration of data regarding missing people and act as a connection between other organizations, national and local governmental authorities.

In 2011 the 'Penelope' Association created a pro bono legal assistance service, made up of lawyers and forensic experts, supporting families looking for their missing family members. A cooperation with the association 'Psicologi per i Popoli' ('Psychologists for the People') was also set up in order to offer psychological assistance to families. The Italian data is disconcerting: approximately 25 thousand people have disappeared since 1974, with an annual growth of 800-1000 people. Out of these, 1651 are Italian children and as many as 8153 are foreign children. To date, 832 bodies have been found and still await identification. In 2006 the regional branch of 'Penelope' was founded in Apulia, south Italy. A total of 1702 people have been reported missing since 1974 and a total of 53 cadavers currently await identification.

In order to describe common psychological conditions, some cases of missing people in Apulia have been included: for family members of missing people, time becomes suspended and indefinite. There is a gradual confusion regarding the perception of time as well as disruption of the sleep-wake rhythm. Everyday activities - routines and work engagements - are all suspended, as the return of the missing person becomes top priority. The absence of a person due to uncertain causes leads to an endless wait, which destabilizes the cognitive system and affects the ability to remember, to reason, to calculate times and distances and to understand time and space. This creates an uncertain social representation of the self, and can even lead to one losing the perception of reality.

In order to maximize the efficacy of the autopsy as well as the identification process of human remains, it is necessary to perform a post-mortem examination following Interpol recommendations. The incomplete collection of such data could represent a violation of human rights, because once the fate of a missing person has been determined to be death, all available means must be undertaken to ensure recovery of the body and any personal effects.

Greater emphasis needs to be placed on the role of the forensic odontologist and on their collaboration during the autopsy of unidentified cadavers, regardless of the circumstances. Of the 832 bodies it appears that only 61 bodies received an odontological assessment with a proper odontogram charting. The failure to routinely employ odontologists in missing persons investigations may result in a reduction of additional findings which, together with other circumstantial evidence, could lead to a delay in positive identification and actually prolong the condition of suspended grief, a situation which needs a body, even if such a body is lifeless, in order to bring a ritualistic 'end' to the relationship.

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***KEYWORDS*:** Forensic Odontology, Missing and Unidentified people, Human Rights.

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ORTHOGNATHIC SURGERY- A GOOD GUISE

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The author declares to have no conflict of interest.

It's a known fact that fugitives on the run guise themselves to prevent detection. With good facial surgery being undertaken frequently, law enforcing authorities have a torrid time tracing the offender with a new face Orthognathic surgery to a large extent offers a good guise as criminals go scott free for a longer period of time. Hence meticulous record keeping is the order of the day and every suspect should be radiographically examined for the presence of surgical hardware in the facial skeleton. In suspicious cases the surgeon too needs to be tracked down to assist investigation

KEYWORDS: Forensic Odontology, Orthognatic surgery, Fugitives.

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IS THE FREQUENCY OF NON-METRIC DENTAL TRAITS DISTINCT IN INDIANS? A PRELIMINARY ANALYSIS BASED ON TOOTH ROOT NUMBER

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The authors declare that they have no conflict of interest.

A The objective of the study was to generate preliminary frequency distribution of root number(s) of select teeth in Indians with a three-fold view—(1) compare the data to that of major population groups (or 'races'), (2) determine if a trend exists in allocating Indians to one of the major population groups based on root traits' occurrence, and (3) ascertain the necessity and use of population-specific data in categorising Indians. These have the potential for physical profiling of skeletonised remains of Indians in forensic and anthropological scenarios. Periapical radiographs of 211 adult Indian subjects were evaluated for the incidence of two-rooted maxillary and mandibular first premolar, three-rooted first and single-rooted second mandibular molars. In addition to population comparison of the root trait frequencies, Bayesian analysis was performed to assess the probability of assigning Indians to the various population groups. Two such analyses were undertaken — the first which excluded Indians and the second that included them. In both, the frequency of the highest probability (in %) categorising an Indian subject to the population groups was noted.

Two out of four root traits compared were outside the range available for different racial groups while one was on the fringes of existing world data. One was within the range available for different racial groups. The root trait frequencies were not similar to any specific geographic subdivision and each approximated a different race. Furthermore, Bayesian analysis which did not include Indian data in the cross-tabulation, showed no predilection of Indians to be allocated to one particular race, with probabilities of group prediction to the different races being similar, in particular Sub-Saharan Africa and Western Eurasia. On the other hand, Bayesian analysis which included Indian data in the cross-tabulation, showed a predilection to categorise Indians to the Indian group. The constellation of root trait frequencies in Indians appears to be relatively distinct from the major human races. This 'uniqueness' precludes grouping of Indians to any particular geographic subdivision and warrants the generation of exclusive Indian database for use in anthropological and forensic identification.

***KEYWORDS*:** format times new roman

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THE ROLE OF FORENSIC DENTISTRY IN IDENTIFICATION OF SINGLE CADAVERS UNDER DIFFERENT DEATH CIRCUMSTANCES: A REVIEW OF THREE FORENSIC CASES' OF BURNING, SUBMERSION AND PUTREFACTION CADAVERS

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The author declares to have no conflict of interest.

For many forensic dentists the identification of found human remains will comprise the majority of their forensic case work. However, there is rarely a typical dental identification. The resilience of teeth and their supporting tissues to peri and post mortem assaults provides a wealth of information for those interested in the identity of the deceased. Chemical attack, burning, burial, submersion, and even severe head and neck trauma are all withstood by the dentition to an extent where identification is possible. The lack of a tentative identification or failure to locate dental or similar ante mortem records is a more common reason for an odontological forensic investigation to fail. The purpose of this cases review is to describe the single dental characteristics employed by forensic dentists to identify human remains under different circumstances of death and also to provide details of some unusual dental identification in pathology forensic cases when dental ante mortem records are few. Such as dental partial removable prosthodontics rehabilitation, a tooth coronary open for a root canal treatment without root canal filling, a splint of contention post orthodontic treatment or the external contour of implant abutments and the respective crowns morphology of the implant prosthodontics rehabilitation.

***KEYWORDS*:** Forensic Odontology, Identification, Cadavers.

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MISINTERPRETATION OF DENTAL EVIDENCE RECOVERED IN CREMAINS

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The author declares to have no conflict of interest.

Cremated remains identification is a fairly uncommon request to forensic anthropologists and odontologists. Family members who suspect the cremains of their loved one(s) to be misidentified, commingled, or mislabeled are often the ones to make such a request for an examination and analysis to ascertain the cremains identity.

Two cases of cremains misidentification will be presented, both of which have been litigated in civil courts. The cases involve cremations done at different times by the same crematorium on cadavers that had been willed to a medical school. In both cases many dental restorations were recovered in the cremains.

Dental restorations and dental structures often survive the temperatures achieved during commercial, accidental, homicidal or suicidal cremations. From the surviving dental evidence a comparative dental identification can often be made with the antemortem dental record to determine the identity of the cremains.

The first case involved the examination of cremains that were purported to be an elderly male who had willed his body to a medical school. Once the medical school had completed its study of the cadaver, a crematorium was contracted to perform the cremation, return the cremains to the medical school who in turn delivered them to the next of kin. The family had suspicions of the identity upon receiving the cremains because of labeling on the temporary urn, and media news stories relating to problems with the crematorium and medical school. An examination of the cremains done by an ABFO certified odontologist concluded the cremains were not those of the purported decedent. A second analysis of the cremains by an ABFA certified forensic anthropologist concluded the remains were "consistent" with the purported decedent and in a subsequent report stated that the cremains probably were those of the purported decedent. A third analysis was conducted by different ABFO certified forensic odontologist (the author), who concluded that the cremains were not the purported decedent. The presentation will focus on the dental evidence recovered, the antemortem dental records, the comparison between the two and the misinterpretation of this evidence.

A second case involving the same medical school and crematorium will be presented, describing a technique of cremains analysis and the recovery of non-biologic artifacts. As in the previous case, the dental evidence recovered does not agree with the antemortem record of the person purported to be the cremains.

The analysis of dental restorations and dental structures recovered in the cremains as well as the interpretation of the antemortem written and radiographic records should be done by a forensic odontologist. Dental nomenclature, dental anatomy, knowledge of restorations, materials, devices and clinical dental experience are needed to review and compare the dental remains with the antemortem dental record, which are beyond the training and experience of a non-dentist

***KEYWORDS*:** Forensic Odontology, Identification, Cremains.

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ATYPICAL POSTMORTEM DENTAL IDENTIFICATION

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The author declares to have no conflict of interest.

Reasons that a forensic dental comparison is an ideal instrument in death investigation include the longevity and durability of the oral/dental anatomy, even in scenarios of extreme heat, trauma, decomposition or a combination of all of these factors. Identification by dental record comparison is universally recognized and consistently accurate. There are scenarios however, despite thorough investigation, antemortem dental records are not available. We will detail the alternative investigative methods we employed that resulted in positive identification, without antemortem dental records. In each case discussed, identity was confirmed utilizing an alliance of forensic dental autopsy, antemortem medical records or differential non-radiographic oral anatomy. With each case example, a greater knowledge of the scope and advantage of contemporary forensic odontology as an augment to identity investigation will be gained.

Our first case involved a male that autopsy confirmed the cause of death as inhalation of products of combustion and manner of death as suicide. Antemortem dental records were not recovered, however medical radiographs of the head and neck were available. A forensic odontologist was summoned and antemortem digital radiographs, a frontal and lateral skull series highlighting a medical implant on the cervical vertebra, were offered for analysis. The dentition was visible on both radiographs and postmortem dental radiographs were created. A positive identification was rendered based on the comparison of dental restorations.

Our second case involved a male that autopsy determined the cause of death as coronary artery disease with contributing factors of drowning and chronic alcohol abuse, the manner of death was accidental. A forensic odontologist was requested to complete a dental identification, but only recent frontal and lateral CT scans were available. Postmortem dental radiographs were taken and a positive identification was rendered after, precise antemortem image improvement to allow for a strict comparison of the decedent's restored teeth.

Our third case involved a vehicle collision yielding two fatalities, a male youth, and an elderly female. The bodies of both were charred and identification by dental record comparison was ordered. Antemortem dental records for the female victim were obtained and her identification was made without difficulty. Only study models of the youth's teeth, prior to orthodontic appliances were available. Dental impressions were collected on the decedent and models created for comparison. The distinctive pattern of the palatal rugae antemortem and postmortem had numerous consistencies

and no unexplainable inconsistencies upon direct comparison. A positive identification was rendered based upon this comparison.
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***KEYWORDS*:** Forensic Odontology, Identification, Atypical.

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HEAT-INDUCED SHRINKAGE AND SHAPE PRESERVATION OF TEETH: A RADIOLOGIC EVALUATION

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Background: ***Teeth subjected to high temperatures following natural disasters, airplane crashes or house fires can sometimes be the only remains available for forensic identification. The information on macro- and microscopic heat-induced changes of teeth can therefore provide relevant information that can facilitate the identification process. An important macroscopic feature of burned dental remains is the gradual change in colour due to compositional changes (i.e. loss of organic content), which generally allows to deduce a temperature range and can indicate the possible preservation of DNA. In practice, the most reliable and frequently applied method for identification of fire victims is comparative dental radiography, based on the comparison of dentition features. Although forensic odontologists are often confronted with fragmented and isolated dental remains, there is still a lack of precise data for the heat-induced dimensional and morphological changes of human teeth that might influence the identification process.***
This study therefore investigated the volumetric shrinkage, shape preservation, weight loss and colour alterations of human teeth and looked at the effects of previously reported heating protocols to enable testing the reliability and inter-comparability of results published in literature.
Materials & Methods: ***A total of 104 freshly extracted sound molars and premolars were included in this study. Micro-CT scans (SkyScan 1172; voxel-size 13.5µm) were performed before and after exposure to three different previously reported heating regimes in a range of 400 - 1000°C. Volumetric shrinkage was analysed using Fiji and 3D Slicer software. The weight loss was documented with an high-precision analytical scale. Photographic colour measurements and image analysis were performed on calibrated digital photographs and representative colour palettes were computed for every experimental group using the Fiji software package.***
Results: ***A progressive, temperature-dependent shift of colours was observed, with apparent differences depending on the chosen heating regime. Although fragmentation and cracks at elevated temperatures often affected the pulp chamber and root canals, overall tooth morphology was well preserved. The temperature and the chosen heating regime had a statistically significant influence on the dentinal volumetric shrinkage, which ranged from 4.8% (at 400°C) to 32.5% (at 1000°C). A major increase in shrinkage occurred between 700°C and 800°C, whilst no significant statistical difference was found between lower temperature groups. The weight loss measurements overall correlated***

significantly with the shrinkage, with a mean weight loss between 7.8% (at 400°C) and 32.8% (at 1000°C), again significantly differing between the heating regimes.
Conclusions: ***In conclusion, the findings of this study showed definite differences of the macro- and microscopic changes related to the experimental heating regime, adding information on the dentinal shrinkage and shape preservation over a large range of temperatures found in possible forensic scenarios. The colour changes are summarised in the newly developed colour palettes and can be used to deduce a temperature range. By vigilantly implementing the knowledge on the specific colour changes, dentinal shrinkage and shape preservation the odontological identification process of fire victims can eventually be facilitated in cases where only fragmented or isolated dental remains are present.***

KEYWORDS**:** Forensic Odontology, Identification, Heat.

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THE ROLE OF FORENSIC DENTISTRY IN FIRE SCENE INVESTIGATION: DETERMINE THE DIRECTION AND THE TEMPERATURE OF FIRE BY DENTAL BIOMATERIALS EVIDENCE IN A BODY BY NOT-SO-SPONTANEOUS HUMAN COMBUSTION

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The author declares to have no conflict of interest.

Fire investigation involves the examination of all fire-related incidents once firefighters have extinguished the fire. The practice is similar to the examination of crime scenes in that the scene must be preserved and evidence collected and analyzed, but with numerous additional difficulties and dangers. The primary purposes of a fire investigation is to establish the origin (seat) of the fire, the temperature of the fire, determine the likely cause, and thus conclude whether the incident was accidental, natural or deliberate.

In December 2012, the body of 89-year-old woman was discovered in her Portugal home by a member of her family. Actually, only part of the body woman's, the legs were found. The rest of her body had been burned to ashes without scientific criteria to identify her. A hole in the kitchen floor and roof was the only evidence of the fire that had killed her; the rest of the house remained perfectly intact. The first hypothesis when the crime scene investigators found the cadaver inside the home was spontaneous combustion because of the external examination of the cadaver refers to the sudden ignition of a material without an external ignition source such as aflame or spark. The phenomenon occurs as a result of exothermic chemical reactions occurring within the material, releasing heat. In cases where the material is piled together, the heat cannot dissipate effectively and so the temperature within the material rises. The rise in temperature causes chemical reactions to accelerate, producing even more heat. Spontaneous combustion tends to be characterized by the apparent source of the fire being the center of the material, as heat is dissipated more readily from the surface, thus resulting in the center reaching the highest temperature. What makes the charred bodies in this forensic case of spontaneous human combustion so peculiar is that the extremities often remain intact. Although the torso and head are charred beyond recognition, the feet, and/or part of the legs may be unburned. Also, the room around the person shows little or no signs of a fire, aside from a greasy residue that is

sometimes left on furniture and walls. However, this is scientific questionable because, first the ignition was present and second the center of the material is not the source, the fire went from the external to internal surface from the cadaver. What happened was, like in some circumstances the fat rendered from a burning body can act in the same manner as the fuel in an oil lamp or candle. If the body is positioned so that oils rendered from it can drip or drain onto an ignition source, it will continue to fuel the flames. This effect is enhanced if there are combustible fuels-carpet padding, bedding, upholstery stuffing-that can absorb the oils and act as a wick.

The investigation should ideally begin with an external examination of the scene by the crime police investigators and then the interior examination of the scene is then conducted, usually with the production of the layout of the scene detailing the location of items and any bodies. Fire effects on certain dental materials can indicate the direction and the temperature of fire. As fire burns upwards and outwards, V-shaped smoke/burn patterns may be found on surfaces adjacent to the fire, with the end of the V pointing towards the point of ignition. However ventilation can affect the path or shape of V-shaped patterns. Smoke deposits of biomaterials surface scan suggest the direction, from which the fire originated, and alloys and plastics tend to melt in the direction of fire, thus distortion of such dental material scan act as directional indicators and indicators of the temperature. The Forensic Dentistry had two main issues to resolve in this particular forensic pathology case, and they were: (1) the scientific identification of the cadaver; (2) the temperature and the direction of the fire in the cadaver.

***KEYWORDS*:** Forensic Odontology, Identification, Fire.

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SEXUAL DIMORPHISM IN CANINE MORPHOLOGY

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Background: ***Different studies have shown that the genes located on sex chromosomes have influence on dental development, including both tooth size and shape. Sexual dimorphism in human canine dimensions is well documented but data on sex dimorphism in canine morphology are scarce. The aim of the present study was to investigate sex differences in canine crown morphology in contemporary Croatian population.***
Method: ***The study sample consisted of male (M) and female (F) dental students, 80 in each group. Distal accessory ridge (DAR) of the upper and lower canines was evaluated on plaster casts using the Arizona State University (ASU) dental anthropology system. Teeth with pronounced wear, caries, fillings and casting imperfections were not evaluated. For the calculation of intra-observer concordance evaluation was repeated after three months on 50 casts. The results were analyzed by log-linear analysis.***
Results: ***Evaluation included 84 F and 105 M upper canines, and 112 F and 100 M lower canines. DAR was more frequent and pronounced on the upper canines ($p<0.000001$). It was found on 66.7% F and 69.5% M upper canines. The trait was more pronounced in males comprising grades 1 to 5, while in females maximum expression grade 5 was not found ($p<0.05$). DAR on lower canines was found on 8.9% F and 41.0% M teeth comprising grades 1 to 4 in both sexes ($p<0.000005$). Intra-observer error was low; difference of two grades or more was found in 7.7% upper and 3.3% lower canines.***
Conclusion: ***DAR showed male-female dimorphism on both upper and lower canines. However, lower canine proved to be better sex indicator. Further investigations on larger sample are needed to make these findings applicable for forensic and anthropologic purposes.***

KEYWORDS**:** Forensic Odontology, Identification, Sexual Dimorphism.

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MANUFACTURED DENTITION FOR TEACHING PURPOSES - THE ISRAEL POLICE FORENSIC ODONTOLOGY VOLUNTEER UNIT

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One of the aftermaths of the Thai Tsunami in 2004, was the adoption of the INTERPOL protocols for identification by the Israel Police. Part of the process involved extensive training of the Forensic Odontology Volunteer Unit, including theoretical and practical teaching. Due to cultural and religious constrains, the use of cadavers for teaching is very limited, in order to overcome this obstacle, a series of complete dentitions was manufactured to mimic the situation of a mass disaster. Each dention was composed of extracted teeth of patients, provided by the members of the unit. The teeth were set in artificial acrylic jaws, which were documented to produce the AM record. Each set of jaws was then submitted to a dentist, who performed various treatments to mimic the PM condition. During their training, the forensic odontologists were required to create AM F1 and F2 forms from the mock dental records and radiographs and PM forms from the artificial dentitions. Data entering using the Plass Data software, matching and identifying were also part of the exercise. The complete training course of the Israel Police Forensic Odontology Volunteers Unit will be presented.

***KEYWORDS*:** Forensic Odontology, Identification, Teaching.

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PERSONAL IDENTIFICATION: RECONSTRUCTION OF GEOMETRY AND 3D PRINTED MODEL ALLOWS THE SKULL TO BE ARCHIVED

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The use of CT is a commonly known approach in the investigation of mummified bodies. It allows 2D images to be obtained and 3D graphic reconstruction. The images can be analyzed for morphological characteristics and pathological changes. They can be also used for anthropometric analysis of the skull and can even replace the real skull in superimposition tests. Nonetheless they cannot replace the skull in the physical sense. The study presents the use of the modern imaging techniques in the identification of a mummified body. The aim of the study was to obtain the maximum possible amount of information and biological profile of the mummy using forensic anthropological methods, thus an autopsy was performed and computed tomography scans were taken. The images from the CT were digitally processed to reconstruct the skull and then to obtain a 3D printed skull model. Validation of the 3D printed skull using a series of anthropometric measurements completed the investigation. It was concluded that the printed replica of the skull fully represents the original 2D and 3D images. The interdisciplinary investigations revealed the usefulness of digital imaging techniques in postmortem studies and personal identification of mummified bodies. As far we know, the digital reconstruction of a skull resulting in a 3D printed model of the skull had never been performed in our country before. Technological advances in printing make this possible for the first time. The use of the replica enables sensitive and delicate material of mummified remains to be saved and allows further research to be undertaken without any intervention to the museum exhibit. The durability of the model and its resistance to damage guarantee the persistence during transport and enable the repeated use of replica. As a model is more durable and less likely to be damaged in transit, it can be used to preserve skeletal evidence, be examined repeatedly in further identification procedures and duplicated for research and educational

***KEYWORDS*:** Forensic Odontology, Identification, 3D models.

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MEDICAL DEVICES IN ORTHODONTICS BETWEEN CLINICAL INVESTIGATION AND CLINICAL USE

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The authors declare that they have no conflict of interest.

In Italy use and clinical investigation involving medical devices are regulated by law (e.g. Legislative Decree 25th January 2010, n. 37, Health Ministerial Circular 2nd August 2011, Health Ministerial Decree 12th March 2013). The manufacturer, or the established authorized representative in the European Community, of non-CE marked medical devices must send a communication to inform the Ministry of Health; this procedure is obligatory, even when the clinical investigation concerns medical device intended use that is different from those that have been the subject of CE mark. Clinical investigations using medical devices bearing CE marking require approval from Ethical Committee, while dental professionals may use in dental practice routinely these devices. In orthodontics, dental professionals may use medical devices "off label", for an indication not in the approved labelling: in such a case, if the intent is the practice of dentistry, and the medical device is not used in the context of a clinical investigation, it does not require the submission of a clinical study protocol to the Ethical Committee; dental professionals have the responsibility to base the use of the medical device on firm scientific rationale and on sound medical evidence, and to inform the patient and acquire his/her consent. When a dental professional uses medical devices (for clinical investigation or for clinical use, "off label" or not), adequate information on the prospects, limits and potential risks of the treatment must be given to the patient.

***KEYWORDS*:** Forensic Odontology, Medical devices, Orthodontics

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OROFACIAL TRAUMA AND THE ROLE OF THE FORENSIC ODONTOLOGIST

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The author declares to have no conflict of interest.

Facial injuries are commonly seen in fatalities resulting from personal assault. It is essential that there is liaison between the case Forensic Pathologist and the Forensic Odontologist in recording these injuries. An extra and intra oral examination by the Odontologist combined with discussions with the Pathologist enables a more detailed comprehensive report being provided to the justice system.
Significantly an intra-oral odontology examination may eliminate suspicious allegations that personal assault had occurred prior to or at the time of death.
A study conducted in Perth, Western Australia into the relationship between soft and hard tissue injuries will be presented and discussed.
A draft proforma to be used when undertaking an Odontology examination of facial trauma will be presented and guidelines for providing a report will be discussed.

***KEYWORDS*:** Forensic Odontology, Identification, Facial injuries.

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NEW ANALYTIC METHOD OF DNA EXTRACTION FROM TEETH

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The author declares to have no conflict of interest.

Background: ***The ISO/IEC standards establishes that every new method used in an accredited ISO17025 forensic laboratory must be submitted to internal validation before processing the samples. This paper aims to verify the efficacy of a new analytic method of DNA extraction from teeth, based on a semi-automatic procedure that permits processing in a single cycle from 2 to 12 samples.***
Methods and materials: ***A sample of 30 teeth were analyzed of which 22 had been extracted over a 5 years and 8 teeth extracted over a period of one-two months. During the extraction a blood sample of the donors was taken as a control; all the samples (teeth and blood samples) were kept at room temperature in separate sterilized containers. The teeth were previously decontaminated and endodontic access to the pulp chamber was performed according to a technique described by Pinchi et al (2011). After the DNA extraction, all samples were quantified by using Quantifiler® Duo DNA Quantification Kit. The genetic profiles obtained from the teeth samples were compared to the STR profiles of all blood samples.***
Results: ***DNA extraction was possible in 29/30 of the samples and in all cases there was a match between the tooth DNA profile and the controls. Regarding the DNA quantification, we note a wide margin of variability (between 0.2 and 350 ng in 60 µl of TE buffer with no inhibitors presence in any sample). These results seem independent of the presence of large damaged/lesion teeth (i.e. dental caries) or atresia of the pulp chambers as well as from the extraction dating.***
Conclusion: ***The successful extraction of dental DNA from teeth removed several years before and maintained without any specific cautions supports the conclusion that pulp is a donor-tissue of first choice in forensic practice. The results confirm a robustness and reproducibility of the extraction method with QIAcube technology.***

***KEYWORDS*:** Forensic Odontology, Identification, DNA Extraction.

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RADIOGRAPHICALLY ASSISTED DENTAL IDENTIFICATION FOR FORENSIC PURPOSES

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The author declares to have no conflict of interest.

Radiology in forensic odontology has been shown to be useful not only in terms of one or a few of dead bodies but also in multiple fatality incidents. Digital radiography is now a typical form of X-ray imaging, where digital X-ray sensors are used instead of traditional photographic film. Identification of the deceased by clinical or radiographic examination of the teeth were analyzed and validated for long ante mortem /post mortem intervals. The various types of digital units and the capturing images methods were used in forensic exercises. Image acquisition was instantaneous; the images were able to be optically enlarged, measured, superimposed and compared prima vista or using special software and exported as a file. These systems can be useful internationally.
Digital radiology and computer tomography has been shown to be important both in common criminalistic practices and in multiple fatality incidents.
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***KEYWORDS*:** Forensic Odontology, Identification, Radiology.

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THE T-SCAN® SYSTEM A TOOL FOR FORENSIC SCIENCE

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The authors declare that they have no conflict of interest.

Background: The reliability of the T-SCAN® III Computerized Occlusion Analysis System (Tekscan Inc., South Boston, MA USA), as a method for occlusion analysis, is consensual among the field dentistry. This system allows accurate records of the time-sequencing and percentage of relative occlusal force between tooth occlusal contacts. This occlusion analysis system uses those variables for the diagnostic of mandibular dysfunctions. The T-SCAN® III System is easier to use than articulator dental reconstructions and simple to organize.
The aim of our study is to optimize the occlusal contact registration by T-SCAN® III System for forensic purpose.
Material and Methods: Fifteen patients from the Dental Clinic of Coimbra, Portugal, with ages between 21 and 30 years old, were randomly selected. The patient was finishing orthodontic treatment and voluntarily provided his contribution to the study. We used the position of maximum inter cuspidation because it allows for the major contacts between dental arcs. Out of 15 patients, forty-five intra-orally records were obtained by a pressure-mapping sensors in three different periods of time. Each record is a 2-dimensional dental arch, in which the occlusal contact forces are surrounded by a yellow outline that locates the contact, while illustrating in colors the differing of occlusal force levels. Occlusal contact data were analyzed in the parameters: bite length, position and force of tooth contact. The records from the same patient and from different patients, arbitrary choose, were analyzed to study overlapping areas. The analysis of variance within and between subjects was made. This analysis was made by Photoshop CS6® Software and SPSS® software.
Results: We obtained three records for each patient. Moreover, from those original records patient and between individuals, overlapping areas were selected. The results support that the largest number of contacts occurs in molar region. Those contacts allows the bigger overlapping areas and also there is an asymmetric distribution of forces in the same individual, left or right. The results show that the variability between subjects is significantly greater than variability within subjects.
Discussion and Conclusion: Within our sampling universe, we obtained one final record from overlapping areas for the same individual. We can get records from different individuals with the same number of contacts and with distinct position and shape. The oneness of dental arch and functional stomatognathic system leads to inter-individual differences in T-SCAN records. Our

results support that it is possible for each subjects to be identified and distinguishes from another by T-SCAN record (98%).The authors conclude that the T-SCAN® III System is an important and a reliable tool for forensic science, for the purpose of identification and bite mark analysis.

***KEYWORDS*:** Forensic Odontology, Identification, T-Scan®.

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IDENTIFICATION OF PERSONS BY THE METHOD OF TRACE CONTOUR CONTRAST IATROGENIC INTERVENTIONS ON PANORAMIC X-RAYS

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The author declares to have no conflict of interest.

Background: ***Among the known methods of computer identification by dental status in EU countries are using DVA (Dental Visual Algorithm), which are used by Interpol for installation and identification of deceased individuals. The principle of this program is compared reports [post mortem and ante (italic) mortem], which are entered into the program as a cipher for each tooth, and has additional information. Designed similar domestic program takes into account the treatment and rehabilitation of common dental diseases in our country. Ciphers which are presented in the "Atlas of Identification by Dental Status" (Ye.Ya. Kostenko, B.V. Myhaylychenko, V.D. Mishalov, V.I. Bida).However, the main disadvantage and inconvenience of program is to write in database of dental status codes manually, which increase the possibility of error in determining the status of each individual tooth and all dental alveolar apparatus.***

The aim of our research is the development and testing of the proposed methods for identification of dental status on the basis of computer analysis of iatrogenic interventions that displays on digital panoramic x-rays.

Materials and methods: ***It is based on the use of the effect of differences in the subject of observation from the surrounding background, which is known as optical contrast. Contrast is defined by the formula as ratio of brightness of the observed objects and the background to one of the brightness. Evaluation of the proposed method was tested in the experiment by 216 panoramic x-rays which have basic digital panoramic x-rays intervals repeated shots of one to five years. Among the 97 surveyed panoramic x-rays belonged to men, and 119 - women aged 18 to 65 years. The first group consisted of 74 people who were taken repeated shots in the first year. The structure of the second group study included 78 people, repeated images that are made in terms of one to three years, the third group consisted of 64 people, repeated shots which were made in three - five years.***

Results and discussion: ***In the first group, the proposed method was identified 85.1% (63 persons) and 14.9% (11 people) had no seals, or they were replaced as a result of re-treatment. In the second***

group was identified 79.5% (62 persons), of which visual assessment of dental status changes seen as a result of total orthopedic treatment removable prosthetics sintered 8.9% (7 people) and 11.6% (9 people) had sufficient characteristic radiographic signs of treatment. In the third group, which had the lowest rates have been identified 73.4% (47 persons), analysis of causes loss of efficiency due to the number of persons who had no dental treatment (age group 18-24 years) 5 persons (7.8%), and persons who conduct voluminous surgical, medical and orthopedic, therapeutic manipulations (12 people - 18.8%).

Conclusions: ***The technique of computer analysis of identity iatrogenic interventions based contrast Trace Contour digital X-ray images have shown to be effective in people who have had enough of treated, restored and orthopedic restored teeth. Application of this technique is effective only in combination with other methods of dental identification.***

KEYWORDS**:** Forensic Odontology, Identification, Radiology.

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EXPERIMENTAL SUBSTANTIATION OF THE METHOD OF IDENTIFICATION INTRAOSSEOUS DENTAL IMPLANTS BY RADIOGRAPHIC SIGNS

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The authors declare that they have no conflict of interest.

***Background**: At the present stage of development of the forensic medical examination and dental identification system has a number of unresolved problems. One of these is the identity through identification implantology systems, which are used in the treatment of tooth defects series. According to V.O. Malanchuk (2006), with more than 300 existing in the world dental implantation systems now in Ukraine are represented 20 , and more than 10 are in the registration process. Among them registered three implant systems of Ukrainian production (Los V.V. 1994; Prytula O.M. Uhryn M.M., 1999; Moseyko O.O. 2001), but adjusted production and widespread have system of "U-impl "and" Vitaplant ".*

The aim of our work is the creation of a universal algorithm to identify intraosseous dental implants by radiographic signs of the method of "contrast Trace Contour dental procedures."

Materials and methods: The study was conducted at the University Dental Clinic of UzhNU for two years and continuing now. The experimental group consisted of 198 patients aged from 32 to 63 years who underwent implant treatment, of whom 102 (51.5%) patients was women and 96 (48.5%) men. We received 594 digital X-ray images (Panoramic x-rays), three each patient (one at the planning stage of treatment, the second immediately after installing the implant and the third later osseointegration and install non-removable prosthetic restoration) identified 346 intraosseous dental implants : 205 (59.2%) units were in the mandible and 141 (40.8%) on the upper jaw and by the criterion of placement in the dental formula : in the lateral section was located 211 units (60.9%), and in front - 135 units (39.1%).We proposed an algorithm is as follows - using, for the classification of intraosseous dental implants according to their structural features in the X-ray (Kostenko Ye.Ya, Beley O.L. 2012), and X-ray data, we gradually define structural elements that equip the implant only for a limited number of systems.

Results and discussion: Following the gradual of identification with using digital Panoramic x-rays and the program "identity iatrogenic interventions" were identified: 162 units of implants, which probably belong to the AB Dental Devices, Blu Sky Bio, ADIN Dental Implants System and Alpha Bio Tec. implantology systems. Conventionally labelled as C1. Of those amounts were identified: 49

units (30.2%) - 3.75x10 mm, 36 units (22.2%) - 4.2x10 mm, 31 units (19.1%) - 4.2x8 mm, 29 units (17.9%) - 3.75x8 mm and 17 units (10.5%) - 3.3x8 mm. 95 units of implants that are probably belong to k3pro konus dental implants, Southern implant and IDI System implantology systems. Conventionally labelled C2. Of those amounts were identified: 31 units (32.6%) - 4.0x9 mm, 26 units (27.4%) - 4.0x7.5 mm, 23 units (24.2%) - 4.5x7.5 mm and 15 units (15.8%) - 3.0x9 mm. And on the criterion placement in dental arch 53 units (55.8%) were in the lateral area and 42 units (44.2%) in the front. 89 units of implants that are probably belong to Astra Tech AB, ARDS implants, Champions Implants GmbH and Ossetem Implant Co, Ltd. (Hiossen) implantology systems. Conventionally labelled C3. Of those amounts identified: 45 units (50.6%) - 3.75x10 mm, 24 units (27%) - 3.75x8 mm and 20 units (22.4%) - 4.2x8 mm. The data obtained we compared with records of operational log between 5.10. 2010 to 10.12 2012 According to the records for this period was found: 163 units of implants system Alpha Bio Tec., 95 units of k3pro konus dental implants, and 88 units of ARDS implants.

Conclusions: According to the data, the proposed method showed a high degree of efficiency. With proper design and implemented it in a system forensics, methods greatly facilitate the identification of affected individuals. Whereas identification of the dental status of individuals post mortem without anamnestic data and the available medical documentation is quite complicated. This technique, will enable professionals to forensic and judicial odontologist determine probable implant system, narrow the search for missing persons by providing forensic investigative authorities information of medical and biological character and rationalize expenditure of time for personal identification.

***KEYWORDS*:** Forensic Odontology, Dental radiology, Implantology.

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DENTAL ASPECTS OF CRANIOFACIAL SUPERIMPOSITION – THE INTERNATIONAL MEPROCS PROJECT

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Craniofacial Superimposition is a scientific process, where an image of a missing person is overlaid onto an image of a skull for identification purposes. The scientific background of this technique is based on the premise that there is a strong relationship between the morphology of the facial skull and the soft tissue features of the human face. The reliability of this technique is increased considerable by the presence of teeth in the antemortem photograph and in the skull which can be superimposed, their morphology, dimensions and spatial relationships serving as guidelines.
Cranial superimposition has been used successfully in missing persons cases as well as in mass casualty incidents like the Thai Tsunami. The reliance on cranial superimposition for identification of human remains varies considerably worldwide. While some investigators rely predominantly on this technique for positive, others tend to consider skull-photo superimposition as a good technique to provide only exclusion of identification. The technological aspects of cranial superimposition have evolved considerably since first reported in 1937. The new methodologies and protocols of forensic identification by craniofacial superimposition (MEPROCS) is an FP7 supported project aimed to create a common EU protocol on the implementation of the technique, relying mostly on fully automatic procedures. The objective of this poster is to present the advantages of including dental information in craniofacial superimposition as an identification technique within the realm of forensic anthropology and odontology.

***KEYWORDS*:** Forensic Odontology, Cranial superimposition, Identification.

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DENTAL MINERALIZATION AS AN INDICATOR OF SEXUAL MATURITY IN GIRLS

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***Background**: Age at menarche and hand-wrist development are the most commonly used indicators to study growth and development in living subjects. Unfortunately, these parameters are unavailable in past populations. However, dental mineralization is a process frequently used for age estimation both in forensic contexts and in bioarchaeology.*

The aims of this study are (1) to measure the correlation between dental mineralization and menarche, and (2) to assess the mean age of menarche by dental mineralization stages.

***Materials and Methods**: The sample comprised 147 girls aged between 7 and 17 years (mean age 12.06 ± 1.99 years). For each girl, one to four panoramic radiographs were collected representing a total of 161 radiographs. The girls were examined in private practice in the South West of France and at Department of Orthodontics (Bordeaux University Hospital) between 2005 and 2013. Dental mineralization stages were assessed by two different methods (1) Demirjian et al. 1973 and (2) Moorrees et al. 1963, based on the evaluation of crown and root mineralization using the seven left mandibular teeth (31 to 37). First, difference between age at examination and age at menarche was defined (subsequently referred as Menarche Examination Difference or MED). Then, the measurements of correlation between development stages of permanent teeth and MED were performed using four different statistical methods (correlation ratio; regression tree; classification tree; and Bayesian inference). Bayesian inference allows to determine the probability of attribution in ante, peri and post-menarche groups for each mineralization sequence.*

***Results**: Using correlation ratio and Demirjian's stages definition, premolars (0.62 and 0.64) appear to be the most correlated teeth with MED, followed by second molar (0.54), and canine (0.51). For the Moorrees' stages, premolars (0.65 and 0.74) are the most correlated teeth with MED, followed by canine (0.52) and second molar (0.52). Regression trees based on Demirjian's stages suggest that (1) until stage F for premolars, and/or second molar, and until stage G for canine, girls belong to the ante-menarche group; (2) after stage G for premolars, and/or second molar, and after stage H for canine, girls belong to the post-menarche group. Regression trees based on Moorrees' stages suggest that (1) until stage R1/2 for second molar, stage R3/4 for premolars, and stage Rc for canine, girls belong to the ante-menarche group; (2) after stage R3/4 for second molar, stage Rc for premolars, and after stage A1/2 for canine, girls belong to the*

post-menarche group. We also generate classification trees to identify the peri-menarche group. For this purpose, minimum and maximum MED, and specific mineralization sequences that are the most predictive were obtained. Bayesian inference strengthens the results previously obtained by giving probability of attribution for each mineralization sequence in ante, peri and post-menarche groups. This probability could be implemented in further samples tests to confirm the results.

Conclusion: Despite the results found in previous studies, it appears that the process of dental mineralization is correlated to menarche in our sample. Correlation between these two indicators cannot provide the accuracy needed for clinical studies whereas it may be useful in bioarchaeological contexts.

***KEYWORDS*:** Forensic Odontology, Dental mineralization, Sexual maturity.

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GONIAL ANGLE IN RELATION TO IDENTIFICATION

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The authors declare that they have no conflict of interest.

Identification of the human remains is an important part of medico legal practice. Evolution and gradual function amendments have led to size and shape changes of the mandibular angle. The purpose of this study was to compare and evaluate the gonial angle in two samples of causation population in terms of long-term skull development. A total of 190 cephalograms (75 forensic subjects and 115 archeological subjects dated to 8th – 12th century) were evaluated. The gonial angles were measured. A comparison of the mean data for the two groups indicates that the mean gonial angle for the for forensic skulls was 124.48 degrees in comparison to the archeological sculls whose mean gonial angle was 119.40 degrees. Unpaired Two-tailed t-test assuming equality of variances showed that forensic and archeological skulls had statistically significant results. Difference was – 5.09 with standard error 1.05 (95 % confidence interval from - 7.15 to - 3.02).

***KEYWORDS*:** Forensic Odontology, Identification, Mandibular Angle.

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CRANIO FACIAL RECONSTRUCTION & SUPERIMPOSITION IDENTIFICATION - A case study of terrorist suicide bomber

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The authors declare that they have no conflict of interest.

Indonesia has been known as the "supermarket of disaster", both natural and man-made disasters, of particular terrorism disaster. Worldwide terrorist activities has led no countries in the world immune for their activities. On October 12, 2002 the biggest terrorist attack occurred in Bali, Indonesia. In this disaster almost 202 people were killed. Several bombing following the above incidence were in Makassar McDonald Restaurant (December 6,2002), JW Marriot Hotel Jakarta(August 5,2003), Australian Embassy(September 9,2004), the 2nd Bali Bombings (October 1, 2005), JW Marriot & Ritz Carlton Hotel (July 17 ,2009) , Most of the bombings did by young age suicide bombers, ordinary people, never committed a crime, brainwashed , militant who consciously have chosen to be a martyr although other alternatives remained open to them. During the identification process we apply the Interpol DVI form and protocol. In these incidents the investigation teams have demonstrated the importance of dental identification. However, the major obstacle was getting ante mortem dental records of all of the victims, especially Indonesian victims. One of the identification techniques known is Cranio facial Reconstruction and Superimposition technique, a method of identification achieved by the comparison of an image of a face or skull overlayed upon an antemortem photograph of a person thought likely to be the same subject , this technique requires unsophisticated devices which is economic, and can be applied anywhere. First in JW Marriot Bombing , Australian embassy bombing, 2nd Bali Bombing and all bombings in Indonesia . The finding of video tape of the 3 suicide bombers after their action one week later in a nearby site close to JCLEC Police Academy Semarang Central Java, has provided a valuable information for Indonesian DVI team.

We did this technique to provide additional information to uncover the identity of the three suicide bombers . It is hope that Cranio Facial Reconstruction & Superimposition technique can be easily transferred to field officers or dentists in developing countries with minimum facilities, since it simple, economic and relatively a quick method .

***KEYWORDS*:** Forensic Odontology, Cranio Facial Reconstruction, Facial Identification

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A SOFTWARE FOR CATALOGING AND IDENTIFICATION OF DENTAL IMPLANTS: A POWERFUL TOOL FOR RECOGNITION AND FORENSIC IDENTIFICATION PURPOSES

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The authors declare that they have no conflict of interest.

***Introduction**: In recent years, with the increasing use of dental implants for prosthetic rehabilitation therapy, and given the multitude of types of implants, it has been thought to use the different shapes, types and lengths for personal identification purposes. The idea of analyzing and comparing the shape of implants is made possible by information and communication technology, i.e. the set of technologies that enable you to process and communicate information through digital means, and through mathematical algorithms of recognition highly complex that are the result of years of study. Everything is easily accessible through a web portal (www.which-implant.com)*

***Materials**: A series of software operating on radiographs through identification of edges has been developed, recognition of the structural elements of binary images, identification of graphs needed to determine with accuracy the outer edge of the shapes, and calculating the geometrical parameters, such as the center of gravity and orientation. Once obtained the geometry of the implant, such data are compared with those stored in a database or with data obtained from another X-ray instrument.*

***Expected results**: Given a X-ray showing an implant and the database of the web portal, the algorithm determines which database model matches better the implant of the x-ray, indicating the percentage of success of the matching with mathematical certainty. Given two X-rays showing two implants, the algorithm says with mathematical certainty expressed as a percentage, if such implants are matching.*

***Discussion**: The analysis of the implants inserted into the bone structure is a non-invasive technique, useful for identification both in the living and the dead. The material to be analyzed is maintained unchanged due to the position within the bone and to the type of material: titanium. The recognition system is valid for personal identification purposes, both of reconstructive and comparative type (forensic). It could also be useful in case of mass disasters for a fast screening.*

KEYWORDS: Forensic Odontology, Identification, Implant Recognition

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METHOD OF IDENTIFICATION BY RELEVANT MATCHING OF X-RAY ORTHOPANTOMOGRAPH

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The authors declare that they have no conflict of interest.

***Background**: Analysis of identification of victims of mass disasters caused by natural disasters, acts of terrorism, military conflicts, air and car accidents show that the vast majority of identifications were made just for dental status. For a comprehensive identification of persons existing methods of identification by dental status require detailed specification of the dental status to make an expert evaluation. Due to this fact there is a need to develop a method of quantitative and qualitative assessment of radiological matches of the unique visualized characteristics of teeth-jaw apparatus to use in a computer complex program "Dental identification."*

***Materials and methods**: Experimental study consisted comparing the radiographs obtained with the database of the University Clinic (2500 images) and then carrying out analysis of the effectiveness of the relevant comparison method. Materials for the study were 220 Digital Panoramic x-rays obtained by orthopantomograph Planmeca ProOne (Finland).*

Based on dental status images were divided into seven groups:

group I: persons who have not been carried any dental procedures;

group II: those whom were conducted only therapeutic intervention, without changing the overall dental status;

group III: those whom were conducted orthopedic manipulation and with included or open-ended defects;

group IV: persons with a modified dental status;

V group: those with partial and complete adentia;

VI group: spot radiographs;

VII group: a control group of persons whose images are not included in the database of radiographic images;

Radiographic images were reduced to a uniform scale, contrast and were correlated to the database of University dental clinic. The proposed method is based on an analysis of the unique identification signs, "X-ray segments", structures, clustering matches and experimental analysis of coincidences that make it possible to assert the identity of the person studied Digital Panoramic images. For each images was found a certain number of unique characteristics of the images that are clearly a set of information, such as: color, object, texture, form between the teeth, molars torque, maxillar sinus margin, fillings and a set of structural cluster segments that characterize the X-ray picture bone structure. Unique characteristics of the image are found by the algorithm "SURF" - Speeded Up Robust Feature, SURF - a method of describing local characteristics proposed as a method that can be used in computer vision to recognize objects.

It is based on the combined results of calculating the descriptor "2D Haar wavelet" and the effective use of the algorithm of the integral image. Haar-like features is adjacent rectangular area in a place where they recognize and produced the sum pixel intensity in each section which calculates the difference between the summary. After receiving the results of the algorithms of the characteristic features they are grouping with the help of the method of data clustering (k-means clustering).

Results and discussion: 5 images are not computer analysis because of inadequate quality. 12 images could not be identified due to lack of informative fragments radiographs. For 21 image analogs in a University dental clinic database were not found. Identification of persons designated as I-IV groups possible with high probability. Identification of persons with VI group depends on the informativeness sighting shot (unique anatomical features) and its quality.

I group	*II group*	*III group*	*IV group*	*V group*	*VI group*	*VII group*
28	*38*	*43*	*31*	*30*	*30*	*20*
28	*38*	*43*	*30*	*23*	*20*	*?*
100%	*100%*	*100%*	*96%*	*76%*	*65%*	*-*

Conclusions: Method of identification by relevant matching of x-ray panoramic images experimentally confirms the effectiveness and can be recommended for use in modern forensic practice.

***KEYWORDS*:** Forensic Odontology, Radiological Identification, Orthopantomograph Comparison.

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SOME MEDICOLEGAL ASPECTS OF ODONTOLOGY (Case Reports)

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The authors declare that they have no conflict of interest.

Forensic odontology is one of the most important tools in medico-legal investigations. Examination of teeth, mandible, maxilla and gingiva helps for personal identification, age estimation, diagnosis of sex, race, poisoning and some congenital anomalies. The impressions of teeth on soft tissues or materials (Bite marks) may provide data for identification of the assailant, date of crime and type of crime. In this work, the significance of bite mark as a guide to the perpetrator is illustrated through a case report of physical abuse.

Practicing dentistry maybe affected by some mistakes that lead to some medico-legal problems. A case report of iatrogenic TMJ dysfunction due to dental work is presented. Also, case reports are presented to show that orthodontic work to correct dental abnormalities may result into changes of very important criteria of personal identification. Keeping dental records is essential to facilitate personal identification in mass disasters, missed unknown persons and criminals.

***KEYWORDS*:** Forensic Odontology, Bite Marks, TMJ dysfunction.

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EGYPTIAN REVOLUTION LET'S KNOW SOME FACTS

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The authors declare that they have no conflict of interest.

The Egyptian revolution is an extraordinary event that takes our attention since 25 January till now.

A group of under-graduate students presented the current work as a scientific activity task during their study in the Forensic Medicine & toxicology department, Cairo University in 2011. They developed a formatted questionnaire to be conducted among the most active age group in this revolution, the youth from 20 till 30 years, in Cairo and Giza in order to clarify some questions about the revolution.

We tried to know the percentage of youth participation in this event, the type of participation, the incidence of injuries, the most common type of injuries, the commonly used instruments, if they seek medical care and the type of medical care afforded to them.

We found that, the percentage of participation is about 99%, where 75% of them exposed to different level of aggression from the police, 91% was in the physical form. Most of injuries were in the form of abrasions and bruises 50% while firearm injuries represent 25%. About 75% seek medical care, and 36.5% of the sample need to carry a weapon to protect themselves or their families.

***KEYWORDS*:** Forensic Odontology, Egyptian Revolution, Injuries.

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POSSIBILITY OF IMPROVING METHOD OF AGE DETERMINATION DURING PATHOLOGICAL ATTRITION

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Diploma for Best Report in 2nd International Conference of Dentistry of Students and Young Scientists, Uzhhorod, Ukraine with Scientific work "Clinical and experimental based research of ways to improve techniques of dental age determination in program of dental status" - Certificate of Achievement for the 1st place in IDSC Lecture Contest, Brno, Czech Republic with Scientific work "Clinical and experimental study for improving methods of determining the age of adults by dental status" - Member of Scientific and Educational Centre of Forensic Dentistry in Ukraine - Head of Student Scientific Society, Faculty of Dentistry, Uzhhorod National University, Ukraine

The authors declare that they have no conflict of interest.

Background*: Determination of biological age of a person plays a significant role in the forensic science, especially in the comparative and reconstructive identification antemortem and postmortem as recommended by Interpol / ICPO (International Criminal Police Organization) and FBI (Federal Bureau of Investigation). Bodies justice use the results to determine the age by dental status in an ethnically heterogeneous society where age indicators affecting the need and opportunity to benefit from the state budget socio-vulnerable persons, illegal immigrants and children; it also influenced on level of criminal responsibility of persons with regard to age limit. Age is the least variable and most probably accurate in determining indicator, since the aging process most independently reflected in changes of the pulp and hard tissues of the teeth than on any other functional systems of the body that are more vulnerable to the effects of pathologies features, constitution and physiological defects. Practical determining the age of adults is possible using morphological techniques of Gustafson G. ("Age determination on teeth"), Bang G., Ramm E. ("Determination of age in humans from root dentine transparency") Johanson G. ("Age determination from teeth"), Maples WR. ("An improved technique using dental histology for estimation of adult age"), and morphologically-radiographic techniques of Solheim T. ("A new method for dental age estimation in adults"), Kvaal SI et al ("Age estimation of adults from dental radiographs"). The most accurate in calculating and rational method is Kvaal et al. technique, which involves calculating ratio of length of crown and root to the length of the pulp, width of the root to the width of the pulp in specifically designated locations, search averages and the use of standardized coefficients for the final result. However, this technique does not provide for the effective use with the presence of hard tissue lesions of teeth, prominent among them being pathological attrition.

***Method**: Morphological and radiographic methods of dental age estimation were experimented on 165 patients of Uzhorod National University Dental Clinic with a purpose to compare the results of real and calculated age. The method of Kvaal et al. was selected as the most rational and perspective with the ability to use digital panoramic x-rays photo. 140 digital panoramic x-rays photo were analyzed using Photodontics, Adobe Photoshop CS3 software. Math analysis was made by using MS Excel 2003, Statistics Pro. The comparison of real age and determined age was made. Based on randomized selection of panoramic x-rays photo of patients with pathological attrition of teeth were selected 88 of them. Accounting changes in pulp and hard tissues during pathological attrition we tried to find new improved coefficient in formulas of Kvaal with a purpose to make result more relative to real age. Also the coefficient of Pearson was calculated with purpose to find relation between the end result of age and different factors during pathological attrition, such as level of attrition of the tooth surface, the deposition of dentine, degenerative changes of the pulp.*

***Results and conclusions**: Individually calculated improved coefficients for Kvaal et al. age estimation technique during pathological attrition made the result more relative to real age. Age estimation technique can be improved accounting morphological changes during pathological attrition and new calculated coefficients make possibility to expand the circle of persons age of which need to be found.*

***KEYWORDS*:** Forensic Odontology, Age determination, Pathological attrition.

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COMPARISON OF DIAGNOSTIC ACCURACY OF FOUR ODONTOLOGICAL METHODS FOR AGE EVALUATION IN ITALIAN CHILDREN AT THE 14 YEARS THRESHOLD USING ROC CURVES

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The authors declare that they have no conflict of interest.

***Background and aim of the research**: In the evaluation of the accuracy of the odontological methods for age evaluation, the age threshold of 14 years is relevant in Italy as the minimum age for criminal responsibility. It is of utmost importance to evaluate the diagnostic accuracy of every odontological method for age evaluation considering the sensitivity, or the ability to estimate the true positive cases, and the specificity, or the ability to estimate the true negative cases. The sensitivity and specificity of the methods are, however, inherently linked, as one increases, the other decreases. According to the aforisma "in dubio pro reo", in criminal cases it is therefore necessary to grant an absolute privilege to the specificity, favouring the methods with reduced false positives rate. A Receiver Operating Characteristic, or ROC curve, is a plot of the sensitivity of a test versus its false positive rate, or (1-specificity). Each point in the graph is generated by a different decision criteria. The Area Under the ROC Curve (AUC) is used to summarize the accuracy of a diagnostic test.*

The objective of this research was to compare the AUC of four commonly adopted methods of odontological age estimation – Demirjian (D), Haavikko (H), Willems (W), Cameriere (C) – in a sample of Italian children between 11 and 16 years considering the 14 years as threshold to be estimated. In addition, new decision criteria are developed to increase the accuracy of the methods.

***Materials and methods**: The sample was composed of 501 digital OPGs of Italian children (257 females and 244 males) aged from 11 to 16 years (4015 to 5474 days).The stage of the morphological maturation of the teeth was evaluated, according to D, H, C and W methods, by three independent examiners. Intra-rater and inter-rater agreements among the operators have been performed using the Intraclass Correlation Coefficient (ICC).The AUC of the 4 methods was compared separately for male and female and for the 3 operators. New decision criteria were selected maximizing the Youden index (Sensitivity+Specificity-1).*

***Results**: ICC ranged from0.85 to 0.92 for intra-rater agreement and ranged from0.81 to 0.88 for inter-rater agreement. At the established 14 years threshold, in the females cohort, in two of the three operators the Cameriere method had the higher AUC value. In the third operator, the Cameriere method showed a high AUC value but not statistically different to the other methods. Similar results occurred also in the males cohort. In Willems e Demirijan methods the decision criteria coincided with the 14 years threshold. In Haavikko and Cameriere methods the new decision criteria was lower than the 14 years threshold. In females using 12.867 years as a decision criterion for Cameriere, the sensitivity was 87% and the specificity was 85%.In males using 13.221 years as a decision criterion for Cameriere the sensitivity was 78% and the specificity was 81%.*

***Conclusion**: Among the four odontological methods for age estimation adopted in the research, the Cameriere method showed the highest AUC either in the females or in the males cohort. Cameriere's method shows, therefore, a high accuracy at the 14 years threshold, even if it has not been developed to be used in individuals older than 14. Using Cameriere's method, to estimate the 14 years threshold more accurately, we suggest that the decision criterion be set at a lower value.*

***KEYWORDS*:** Forensic Odontology, Age Estimation, Demirjian, Haavikko, Willems, Cameriere.

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AGE IDENTIFICATION BY DENTAL MEANS IN DOWN SYNDROMIC INDIVIDUALS

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The authors declare that they have no conflict of interest.

***Background**: Down syndrome (DS) is the most well known and common chromosomal disorder in humans. Recent birth statistics in the United States show an increasing prevalence, currently observed at 11.8 per 10,000 births. Down syndrome is one of the major cause of mental retard associated with congenital anomalies and dental agenesis. Dental anomalies, especially agenesis, are very common, both in the primary and permanent teeth, and they occur with an incidence five times greater than in the non-affected population. In the primary dentition, the most commonly absent teeth are lateral incisors, while in the permanent dentition, third molars, second premolars and lateral incisors, in this sequence, are the most frequently missing teeth. The dental eruption timing in DS children is different from non-syndromic individuals, many. Authors stated that the eruption of primary and permanent teeth is delayed and that the primary teeth not always had their complete formation before the age of 5 and that female are later than male. Nowadays the importance of the age estimation is increasing because of immigration and adoption reasons, we are asked to determine the scholar or the majority age as much as possible precise. Determining a child's chronological age and stage of maturation is particularly important in forensic and anthropological fields particularly when only immature skeletal remains are available, or for ethical reasons when many babies with anomalies are abandoned without birth documents in reception centers. However, very few studies have been done on people, who for genetic reasons, does not have characteristics of dental and physical development comparable with non-syndromic individuals.*

***Aim**: The aim of this study is to estimate the dental age in syndromic individuals affected by X-21 trisomy in order to evaluate whether the genetic syndrome affected the velocity pattern of dental mineralization.*

***Material**: A sample of 47 patients (23 males and 24 females) aged between 7 and 22 years was selected. All subjects were affected by X-21 syndrome. The chronological age was calculated in days (date of X-rays examination - date of birth). Panoramic x-ray was used to analyze teeth anomalies such as agenesis and to evaluate the dental age. The control group was represented by 47 people with no genetic anomalies, the selection was partially stratified to ensure that all age groups and both sexes were adequately represented.*

***Methods**: Willems', Cameriere's and Demirijan's original methods with were applied to stage the dental maturation. The wisdom teeth have not been considered because of the high percentage of hypodontia in DS individuals. Dental age estimations are provided by an operator expert in dental*

age estimation. However the third molars were present in 10 subjects and we added for such cases an age estimation with Demirijan's method based on 8 teeth . The difference between estimated age and chronological age is assumed as variable and compared to the values obtained for non-affected children. The velocity pattern of dental mineralization in DS children will be analyzed for the possible influence of DS on tooth maturation and, then on age estimation procedures.

Conclusion: The relevant incidence of agenesis obstructs the application of common methods for age estimations (Demirjian 7 –teeth method, e.g.) in subjects with DS. A high incidence of notably advanced or delayed (> 24 months) dental development was found, but larger sample is needed to provide definitive conclusion.

***KEYWORDS*:** Forensic Odontology, Dental Age Estimation, Down Syndrome.

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DENTAL AGE ESTIMATION OF LIVING PERSONS: COMPARISON OF DENTAL MRI WITH CONVENTIONAL ORTHOPANTOMOGRAM

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The authors declare that they have no conflict of interest.

***Introduction**: In the last years the need for forensic age estimations in living adolescents increased with migration, particularly from countries where birth dates are not reliably documented. To date, the gold standard of dental age estimation is to evaluate the mineralization and eruption stages of the third molars using an orthopantomogram (OPG). Based on published reference values, the stages are converted in an age estimate in years. However, the use of ionizing radiation without medical indication is ethically controversial and not permitted in many countries. Thus, the aim of this study was to investigate if dental MRI can be used for the assessment of dental age with equally good results as when using an OPG.*

***Methods**: 27 healthy volunteers (19♀, 8♂, age range 13.56-23.11y, median 18.92) with at least two present third molars underwent an MRI scan of the jaw within 14 days after a clinically indicated OPG. The examinations were performed on a 3T Magnetom scanner (TimTrio, Siemens AG, Erlangen, Germany) using an 8-channel receive–only CPC coil (Noras MRI products GmbH, Hoechberg, Germany). The protocol consisted of a 3D TSE and a 3D CISS sequence. Mineralization and eruption stages of all present molars were independently analyzed on OPGs and MR images by two blinded dentists according to the staging system established by Demirjian and Mincer. Pooled data were used to correlate the results and linear regression was performed. Cohen´s Kappa was determined to assess inter-rater agreement.*

***Results**: Out of 312 present molars, 22 teeth had to be excluded from further analysis due to technical reasons. Thus, 290 molars were finally evaluated. The developmental stages could well be differentiated in MRI. The stages found in the OPGs correlated linearly with those in MRI. While mineralization in MRI tended to be associated with stages up to 3 stages higher than in the OPG (linear regression: $y=0.83x+1.22$, $R=0.79$), eruption showed an almost perfect correlation between both methods ($y=1.05x-0.26$, $R=0.94$). The evaluation of the Bland Altman Plot showed a mean of -0.003 and a 95% confidence interval (CI) for mineralization of -1 to 1, and for eruption a mean of 0.076 and a 95% (CI) of -0.5 – 0.6. Inter-rater agreement was moderate for mineralization (OPG $\kappa=0.46$, MRI $\kappa=0.52$) and good regarding eruption (OPG $\kappa=0.76$, MRI $\kappa=0.57$).*

***Conclusion**: The comparison of dental MRI with the OPG demonstrates that there is a good correlation between both imaging methods. Reasons for the observed differences for mineralization might be that there exist more stages for mineralization than for eruption. Although more data is needed for statistical validation, these results could be the first step towards a replacement of the OPG by MRI.*

***KEYWORDS*:** Forensic Odontology, Dental Age Estimation, Dental MRI, Orthopantomogram.

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COMPARISON OF THE VALIDITY OF THREE DENTAL METHODS FOR AGE ESTIMATION BASED ON TEETH ROOT TRANSLUCENCY

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The authors declare that they have no conflict of interest.

***Background**: Age estimation has a very significant role in the identification of human remains both in forensics and anthropological field. The methods used give us the opportunity to determine age in adults and subadults, both dead or alive. Among the numerous dental methods which exist for adults aging, the evaluation of the root translucency is one of the most useful.*

***Method**: The correlation between biological age and dentine transparency is well known, so the aim of this study is to evaluate the same correlation in teeth with pathological processes. 100 extracted single-rooted teeth were analyzed from 69 subjects of known age of white race (35 F, 21 M, 13 of unknown sex). The length of the root, of the dentine transparency and of the loss of periodontal attachment were measured for each tooth and then the estimated age was calculated according to Lamedin, Prince & Ubelaker and Singhal et al methods. These data underwent statistical analysis*

***Results And Conclusion**: This study showed the utility and the applicability of dental methods in forensics, to determine adults' age at the moment of death. Using the Student's t-Test, age estimation was more accurate with Singhal et al and Prince & Ubelaker methods than Lamedin method. The distinction of the sample by gender was very useful, in fact the Prince & Ubelaker method was more precise than the Lamedin one. The Singhgal et al method was predictive for the age estimation proving to be reliable in the evaluation of pathological teeth, too.*

KEYWORDS: Forensic Odontology, Age Estimation, Teeth root translucency.

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A NEW APPROACH TO MEASURE PERFORMANCE OF DENTAL AGE ESTIMATION METHODS

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***Background**: The accuracy of dental age estimation methods is usually measured as the mean difference between dental and chronological age, however this does not reflect performance over an age range. The aim of this study was to measure performance of dental age estimation methods across age categories as well as a single value for a test sample.*

***Design**: This was a retrospective study of archived dental panoramic radiographs of 946 children aged 3-16. Dental age estimation methods tested include dental maturity scores (Demirjian, Willems, Nolla), pictorial charts (Schour and Massler, Ubelaker and the London Atlas) and tooth specific methods using Demirjian and Moorrees tooth stages (using I1 to M2 and only M2). Mandibular left teeth (excluding third molar) were assessed using each method and dental age estimated for all dentally immature individuals. Accuracy of dental age estimation methods was calculated as the mean difference and absolute mean difference between dental and chronological ages. The number of one year categories with at least 50% of children correctly assigned was counted.*

***Results**: The number of age categories with at least 50% correctly assigned children ranged from one (Demirjian) to nine (London Atlas). The oldest age category with at least 50% correctly assigned children was 13 years. The London Atlas performed best in all measures. Several methods, including Willems, had good accuracy but attained only at least 50% correct age category assignment in 4 or 5 age categories.*

***Conclusion**: The London Atlas performed consistently better than all other dental ageing methods, probably because it was specifically designed to estimate age.*

***KEYWORDS*:** Forensic Odontology, Dental Age Estimation, London Atlas.

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THE TRIPLE TEST: AGE ESTIMATION PROTOCOL FOR UNACCOMPANIED FUGITIVES DEVELOPED AT THE KU LEUVEN, BELGIUM

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The authors declare that they have no conflict of interest.

Most of the forensic dental age estimations need to be performed within the context of migration and asylum procedures. Based on the children's rights (Resolution 44/25, 1989) the protective status as a child has to be given to immigrating unaccompanied children. Related to immigrating people the age of onset of maturity as defined in the country of arrival has to be considered. The authorities of the countries in which immigration is requested, have the right to check the age of the applicant. Hence medical age estimation tests are used. As an example the age examination protocol for unaccompanied young fugitives developed at the Katholieke Universiteit Leuven (KU Leuven) and applied in Belgium, is described. The protocol is mainly based on dental age estimation and integrates at least three gender-specific tests. Therefore, it was named the "Triple Test".

The Triple Test is performed after obtaining an informed consent from the applicant. It starts with a clinical dental examination to exclude diseases or syndromes possibly influencing tooth and skeletal development. Furthermore, this examination allows to obtain a clinical impression of the dental age of the applicant. Consequently, the number of teeth, the amount of decay, stain, and restorations, the positions of the periodontal attachment, the degree of attrition, especially on molars, and the dental occlusion are evaluated. The examiner registering the clinical impression is biased seeing and clinically examining the applicant. Therefore, all other parts of the Triple Test are also performed by a second examiner, independently. In case the final results of both examiners are in disagreement, the tests are reconsidered until a full consensus is reached.

Next a dental panoramic radiograph is taken and evaluated. If developing permanent teeth (except third molars) are observed, the age is estimated based on the registered developmental stages of the mandibular left permanent teeth using the Willems et al. (2001) method. In case all

permanent teeth (except third molars) are mature, the age is estimated based on the registered developmental stages of the available third molars and taking into consideration the missing third molars. Therefore, the Bayesian method developed by Thevissen et al. (2009) is used. Besides, the latter method allows to calculate the probability of an applicant being older or younger than the age of maturity (18 years according to Belgium's law).

Additional to the panoramic radiograph, a hand wrist radiograph of the non handedness side is taken to verify the obtained dental test result. Therefore, the ossification of the hand wrist bones, in particular, the ossification of the radius and ulna is considered with use of the Greulich and Pyle atlas (1959).

On the occasion that the hand wrist bones are mature, supplementally sterno-clavicular radiographs (frontal and oblique) are taken to observe the ossification of the medial part of both clavicles. Accordingly, the age is estimated based on the Schmeling et al. (2004) method. The evaluation of the clavicles allows to estimate an age, even when all available third molars are completely mature.

The Triple Test considers different age related biologic variables and the obtained test results eventually allow, to define the estimated age more accurately, to evaluate a wider age range and to get confirmations between test results. Due to biologic variance between persons, scientifically unexplainable discrepancies between the test results can exist. In that situation, doubt about the estimated age exists, and the Belgium law prescribes that the medical test delivering the youngest age result has to be taken into account (Wetgeving, 2002).

***KEYWORDS*:** Forensic Odontology, Age Estimation, Triple Test.

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THE WEIGHTED AVERAGE METHOD 'WAM' FOR DENTAL AGE ASSESSMENT

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The authors declare that they have no conflict of interest.

***Introduction**: There has been no systematic assessment of the weighted average method compared with an UnWeighted Average. The purpose of this work was to compare the age of subjects assessed using the unweighted –tds, and meta-analysis using fixed and random methods. In addition the reciprocal of the sd-tds and se-tds were also used as weighting factors.*

***Material and Methods:** The quantitative data on tooth development stages for this study are reused from a paper published in 2011 (Yadava M et al 2011). A total of ten different methods of calculating the weighted average were used. Results of comparison between Chronological Age and Ages Estimated by the 8 different methods using 50 female subjects*

Comparison - Difference in years resulted : a v b [ca v uwa] -0.352; a v c [ca v n-tds] -0.649; a v d [ca v sd-tds] -0.464; a v e [ca v se-tds] -0.359; a v f [ca v meta-se-fix] -0.343; a v g [ca v meta-se-rnd] -0.272; a v h [ca v meta-sd-rnd] -0.028; a v i [ca v meta-sd-fix] -0.005; a v j [ca v 1/sd] -0.169; a v k [ca v 1/se] -0.290

***Discussion**: This is compelling and objective evidence of the need to test in a systematic way any mathematical or statistical procedure by which age estimates are made. It is clear that it is, perhaps, the almost unique availability of large numbers of Dental Panoramic Radiographs taken for clinical purposes that are available for re-use that enables this process of validation to be carried out using the different methods of estimating age. All or any one of these can easily be tested against the Gold Standard of chronological age (CA).*

***Conclusions**: The process of weighted average as applied to Dental Age Assessment has been shown to be of value when the reciprocal of the sd is used. Although it is not quite as accurate as Meta-analysis, it is sufficiently close to use so that the expense of meta-analysis software can be avoided. The results presented here question the need for complicated statistical manoeuvres to estimate dental age.*

***KEYWORDS*:** Forensic Odontology, Age Estimation.

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A SOFTWARE FOR AGE ESTIMATION BY PULP/TOOTH RATIO IN CANINES USING PERI-APICAL X-RAYS

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Age estimation in adults is one of the most fascinating challenges for anthropologists and odontologists both in the forensic and biology fields. Many techniques have been studied to determine the age evaluating various anatomical districts, the pelvis, the ribs, the teeth, etc.

Most of these techniques presents serious problems regarding the estimation of the subjects in the elderly age and present very wide age range. Among the various districts teeth have proved those with possibility to study the most interesting, also for their ability to withstand overtime. In this context, several articles have been published regarding the apposition of secondary dentin especially apical x rays. Cameriere et all. since 2004 have studied this process by assessing the results of different samples.

This project, based on the results obtained in previous articles, is focused in the development of software to study and evaluate the images from the apical x-rays to automatically determine the age of the subject. Of the preliminary results have been obtained in the segmentation of the dental pulp.

The processing procedure is based on a particular spatial filter that takes into account the peculiarities of the problem. In fact the usual segmentation techniques generally give unsatisfactory results.

***KEYWORDS*:** Forensic Odontology, Age Estimation, Cameriere.

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AGE ESTIMATION BASED ON A 3D CBCT STUDY OF THE PULP CAVITY AND HARD TISSUES OF THE TEETH FOR FORENSIC PURPOSES

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The authors declare that they have no conflict of interest.

***Background*: The age estimation is a mainstay of the reconstructive identification pathway of the living individual as well as of the dead, and, among the others, the odontological methods are considered to be quite reliable. In the adults, the dental age can be estimated by the analysis of the progressive physiological and degenerative phenomenons which affect the tooth and, among them, the secondary dentinal apposition. Along with the hystopathological methods of dental age estimation, the recent introduction of the devices for the three-dimensional processing of the radiographic images of the teeth – such as the modern CBCT – allows the adoption of a non-invasive/destructive, reliable and rather accurate method for dental age estimation.**

***Aim*: The aim of the present research is to develop a non-invasive, conservative, reliable, accurate and simple method of dental age estimation by mean of the analysis of the volume decrease phenomenons which affect the pulp cavity of the teeth, . The experimented method provides a specific software which allows the measurement of the volume of dental tissues on the base of the three-dimensional radiographic images of the CBCT**

***Materials and Methods*: We have randomly selected 295 CBCT radiographs of caucasian subjects made for ordinary clinical purposes (Scanora 3D dental cone beam unit - Soredex, Tuusula, Finland). The sample of the CBCTs consists of an equal distribution of the number of the radiographic exams in the male/female genders and in the cohorts of age between 15 and 65 years The image of the upper left central incisor has been extrapolated from the radiographs with**

a dedicated software in DICOM file format (OnDemand 3D software - CyberMed Inc, Seoul, South Korea). To measure the volume of dental tissues, the images have been then elaborated

with an innovative method providing a geometric approximation of the dental figure: the ratio "pulp cavity volume/dental hard tissues volume" has been obtained and then correlated with the age of the subject.. The results have been statistically analyzed.

Results: The research is still in progress and it needs to be implemented with the results from a larger number of exams before drawing final conclusions. Anyway the preliminary results are encouraging since the CBCT allows a precise and accurate measurement of the volume changes of dental tissues caused by ageing. Moreover the study of the volume instead of the linear or area measurement of the dental structures seems to be a promising approach, being the volume less influenced by x-rays distortion. Hence the method offers the best chance to reveal and to measure the correlation of such volume changes with the age of subject thus obtaining useful evidence to assess age of an adult in the forensic practice.

Conclusion: The presented method is a promising tool in the procedure for age estimation, permitted by the high technological level achieved by the currently available machines for the CBCT. Due to the correlation with age, the low dose exposure to x-rays, the conservative and easy approach, the save of time and the economically irrelevant difference in costs between the OPG and the CBCT exam, the adopted procedure can be considered technically reliable and affordable for forensic purposes.

***KEYWORDS*:** Forensic Odontology, Age Estimation, Pulp volume, CBCT.

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ETHNIC VARIATIONS AND AGE EVALUATION OF LIVING CHILDREN, A FORENSIC EXAMINATION

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The authors declare that they have no conflict of interest.

In July 2012, we were requested by a magistrate to verify the age of a child of African origin (Burundi) adopted by a French family, with for mission: " - say if the date of birth mentioned Devote's birth certificate, on June 5th 2004, is compatible with the physical development of the child, - In defect say if the date of birth mentioned on blood tests realized in Burundi, on January 8th 2003, is compatible with the physical development of the child." If the child were born in 2004, she would be 8 years old at the expertise date; if she were born in January, 2003, she would be 9½ years old.

The comparative study of the degree of maturation of Devote's teeth with the tables of eruption from anglo-saxon studies (Atlas of Schour & Massler, Atlas of Tooth Development and Eruption/ Reproduction de Sakher AlQahtani) and French studies based on a compilation of the existing tables (Teleradiographies Crétot) indicates an age of 11½ years old ! Luckily, the consultation of a child of Congolese origin, born in France upon the arrival of her parents, and 9 years old, allowed to compare both panoramic radiographies : Devote's picture was almost superposable with that of Rozine. It is from this new radiographic element that we concluded that Devote was 9½ years old, and thus that the date of birth to be retained was the one of the blood analysis, January 08th, 2003.

The conclusions of the forensic scientist from atlas of Greulich & Pyle indicated initially an age of 12 years, age that he maintained in spite of our information. This expertise reveals the impossibility to use the existing dental eruption tables for the foreign nationals of the countries of Africa, India and even eastern Europe. We shall express our wish to create atlas of dental arches radiographies according to every country and to make all the member associations of IOFOS participate to a common protocol of edition of a Dental Eruption Atlas by member country.

***KEYWORDS*:** Forensic Odontology, Dental mineralization, Age Estimation.

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DENTAL AGE IN CROATIAN CHILDREN WITH HYPODONTIA

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The authors declare that they have no conflict of interest.

***Background*: The purpose of this study was to compare dental age of hypodontic children with dental age of age- and sex-matched healthy children from general Croatian population.**

***Methods*: Dental maturity of 125 children (70 girls and 55 boys) with hypodontia, aged 7.1 to 14.6 years, was evaluated from panoramic radiographs, and compared to the number-matched, age-matched and sex-matched healthy children. Mean biological age of the children was 10.7 years. Dental stages were assessed using the Haavikko method. Dental age was calculated as the mean age of all teeth from all four quadrants except third molars, in accordance with the Finnish dental maturity reference values. Teeth that were missing in children with hypodontia were not evaluated in healthy controls. The teeth with completed growth and development were excluded from calculation of dental age. Paired t-test was used to establish group differences between hypodontic and healthy children of both sexes.**

***Results and conclusion*: In both groups of children, the Haavikko method underestimated the chronological age. In the sample of tested children with hypodontia, dental age significantly differ compared to sampled healthy controls and this suggests that tooth formation in children with hypodontia is delayed compared to healthy children.**

***KEYWORDS*:** Forensic Odontology, Age Estimation, Hypodontia.

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DENTAL AGE ESTIMATION IN MALAY CHILDREN BASED ON ALL PERMANENT TEETH TYPES

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BDS from University of Malaya, Malaysia in 2008. He then worked as a general dentist with the Ministry of Health Malaysia in the northern part of Borneo Island for three years before embarking to new journey as an academia at Department of Oral & Maxillofacial Diagnostics and Medicine, Faculty of Dentistry, Universiti Teknologi MARA. During his stint with government clinics in Borneo he received and evaluated numbers of disputed age refugees and immigrant workers. In 2012 he completed his master's degree (MSc) in Forensic Odontology at Katholieke Universiteit Leuven, Belgium and he is a professional member of The Forensic Science Society UK (MFSSoc).

The authors declare that they have no conflict of interest.

***Background*: Since the early study by Demirjian and co-workers in 1973, the Demirjian method has been widely used as a method of choice for dental age estimation. However, due to overwhelming discrepancies in arriving at accurate estimated age by several subsequent studies, Willems and co-workers has modified the statistical method of original study by performing a weighted ANOVA on Belgian children in order to adapt to the scoring system. The purpose of this study was to i) evaluate the applicability of the Willems dental age estimation method in Malay children ii) develop and verify a Malay-specific age prediction model based on the Willems method and iii) to assess the age prediction accuracy by adding third molar information in the Willems model.**

***Method*: Panoramic radiographs (n=1403) of Malay children aged between 4 and 14.9 years (n=702) and sub-adults aged between 15 and 23.9 years (n=701) were collected. This sample was split in a reference sample to develop a Malay-specific prediction model based on the Willems method and in a test sample to validate this new developed model. The left mandibular seven permanent teeth of the children were scored based on the staging technique described by Demirjian and converted to age using the Willems method. Next, the incorporation of third molars into this model was analyzed. Third molar development of all individuals was staged based on the technique described by Gleiser and Hunt modified by Kohler. Differences between dental age and chronological age were calculated and expressed in mean error (ME), mean absolute error (MAE), and root mean square error (RMSE).**

***Results**: The Willems model applied on the collected Malay children overestimated chronological age on average (ME) 0.45 years (SD = 1.4 years). Small differences in ME, MAE, and RMSE between the verified Malay-specific prediction model and the Willems model were observed. An overall neglected decrease in RMSE was detected adding third molar stages to the developed permanent teeth model.*

***Conclusion**: Although the Willems model verified on Malaysian children overestimates chronological age, no strong indication was found that warrants the development of a Malaysian-specific prediction model based on a large Malaysian reference sample. Adding age-related third molar development information to age-related permanent teeth information is only ameliorating the age prediction accuracy in the age group of children between 14 and 16 years.*

***KEYWORDS*:** Forensic Odontology, Age estimation, Malay Children, Willem's Method.

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COMPARING 14 COUNTRY-SPECIFIC POPULATIONS ON THIRD MOLARS DEVELOPMENT: CONSEQUENCES FOR AGE PREDICTIONS OF INDIVIDUALS WITH DIFFERENT GEOGRAPHIC AND BIOLOGICAL ORIGIN

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The authors declare that they have no conflict of interest.

Due to the migration aspect, frequently the age of an unaccompanied young fugitive with a particular geographical and biologic origin was estimated using methods or models developed on a reference sample, including subjects with unlike origins. Since dental age estimations in the sub-adult group are based on third molar development, it has to be investigated whether differences in third molar development between populations with different geographic and biological origin exist. Furthermore the consequences on the age prediction performance, estimating the age of an individual from a different geographic and biological origin as the reference sample has to be examined.

In an ongoing data collection, previously 9 country specific samples (Belgium, China, Japan, Korea, Poland, Thailand, Turkey, Saudi-Arabia and South-India) were investigated on third molar development (Thevissen et al., 2010a,b). In the present study 5 new country specific datasets (Brazil, Italy, Malaysia, United Arab Emirates and Croatia) were added, analyzed and compared. The aim of this study is to collect country-specific databases of third molar development, to evaluate and compare third molar development between the collected countries and to detect the impact on the age prediction performance, using a validation sample from a different geographic and biological origin as the reference sample..

A total of 11.250 panoramic radiographs from subjects out of the above described 14 countries were collected. For each country the individuals were, sex specific, homogenously distributed in the age range between 16 and 22 years. Third molar development of all present third molars was

registered, according the ten stages technique of Köhler et al. (1994). Missing third molars received a zero score. Consequently each subject received a third molar score sequence for the upper right, upper left, lower left and lower right third molar respectively. To obtain for each subject a factor score, representing the degree of third molar development in the total dataset, a generalized linear mixed model for multivariate ordinal data was fitted on the third molar score sequences of all subject from the 14 countries. Differences in degree of third molar development between countries were analyzed using gender specific regression models for these factor scores with age and country as predictors.

Comparisons between countries revealed differences in speed and onset of third molar development. Over the different ages the degree of third molar development changed between countries in an unordered way. No clear patterns of differences in degree of third molar development could be distinguished between the countries. Compared to all other countries, Belgium subjects were generally developing fastest. As such, using for age estimations purposes, third molar development information from Belgium instead of country specific information results in under estimated age predictions. This is the best judicial reference if country specific reference information is lacking. Indeed, legally spoken an advantage of the doubt for the individual under examination is then provided.

No evidence was detected for important differences in degree of third molar development between the 14 examined countries. This implicates that geographical differences in third molar development between examined individuals are of clinically negligible influence using age predictions based on third molars development.

***KEYWORDS*:** Forensic Odontology, Age prediction, Third Molar Development, Population Influence.

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WEIGHTED PROBABILITY AT THE 10 YEAR THRESHOLD

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The authors declare that they have no conflict of interest.

***Introduction**: In the United Kingdom, there are specific age thresholds of legal importance. One of these is the 10 year threshold. Below this age, children who have committed a criminal offence cannot be charged in the criminal law system. The conventional approach is to carry out an age estimation using a Panoramic radiograph of the subject. A difficulty with this approach is that lawyers enquire as to the way that the age is estimated and fail to understand the Normal distribution theory. Clinical Practice has shown that the use of probabilities is better understood by lawyers especially when converted to a percentage value. This paper explores the application of simple probability theory and calculations to the 10 year threshold where multiple Tooth Development Stages (TDS) are used to determine the probability that a subject is below the 10 year threshold (p < 10).*

***Material and Methods**: The 'study sample' radiographs and data from Yadava et 2011 were re-analysed for this study. The DARLInG Reference Data Set (Roberts GJ and Petrie A. 2012) was used to provide the summary data.*

***Results**: A sample of 50 females randomly selected from case records from re-use of radiographs all approximately within 2 years of the 10 year threshold 9.2 years to 11.05 years. The calculated Chronological Age and Associated Probabilities was used to create a table as follows*

CA < 10 years ; CA > 10 years

DA-Probability < 10 years Correct: a. 18 [36%] - b. 25 [50%]

DA Probability < 10 years Incorrect: c. 4 [8%] - d. 3 [6%]

This is interpreted as follows:

a. 18 of the 50 study subjects [36%] were correctly identified as being under 10 years of age.

b. 25 of the 50 subjects [50%] were correctly identified as being over 10 years of age

c. 4 of the 50 subjects who were over 10 years were incorrectly identified as being under 10 years of age. This helps the subjects, but does not serve the interests of justice.

d. 3 of the subjects who were under 10 years were incorrectly identified as over 10 years of age.

This is a poor outcome for the subject who is inappropriately deemed to be criminally liable for any offence that has been committed. The interests of Justice are not served.

Discussion: This approach provides a new method of helping social workers, solicitors, barristers, judges and care-workers understand dental age assessment with a reliable method of determining whether a child is above or below the 10 year threshold with a high degree of accuracy.

***KEYWORDS*:** Forensic Odontology, Age estimation, Age Threshold.

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TESTING LAMENDIN'S AND PRINCE & UBELAKER'S AGE ESTIMATION METHODS IN A MODERN GREEK SKELETAL POPULATION

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The authors declare that they have no conflict of interest.

Background*: Age-at-death is an essential biological parameter necessary for the identification of human remains. The most reliable methods for estimating age-at -death from adult skeletal remains are based on the identification of degenerative changes in bones and teeth throughout life. Current techniques are based on the study of morphological changes that occur in the pubic symphysis, the auricular surface of the ilium, and the sternal end of the fourth rib. However, in both forensic and archaeological settings it is not uncommon to recover the pelvis and the ribs in a fragmentary state. In this case, teeth can be used as an additional tool for age estimation as they are resistant to destruction and fragmentation in comparison to skeletal tissues. Lamendin et al. developed a method for age estimation from teeth based on root transparency and periodontosis. They developed an equation for determining age-at-death independently of ancestry or sex. However, Prince and Ubelaker evaluated this technique and suggested that sex and ancestry should be considered when estimating age-at-death based on root transparency and periodontosis. Hence, they created specific formulas for different sub-populations.

Method*: The aim of this study was to test and compare the accuracy of the Lamendin and Prince and Ubelaker age estimation methods in a modern Greek skeletal population. The upper and lower canines of 73 individuals (43 males and 30 females) from the Athens Collection were examined. In the present study, the mean age was 46.02 (range: 24-96 years) and 48.30 (range: 20-85) for males and females respectively. Maximum root height, periodontosis and root transparency height were measured on the lingual surface of each upper and lower canine using a digital sliding caliper. An independent samples t-test for the comparison between right and left

tooth measurements was performed. Pearson's rank correlation statistics were applied to identify relationships between each measured dimension of canines and documented ages. Bias and inaccuracy were calculated to test the reliability of the method.

Results: No significant differences were observed in the measurements between right and left canines (P>0.05). Only periodontosis and root transparency measurements presented statistically significant positive correlation with age (P<0.001). Bias results for both methods showed that there was an underestimation for ages over 40 years and an overestimation for ages under 40 years for both upper and lower canines. The two methods appeared to correspond better with actual ages (small bias and inaccuracy) in the age range of 30-49 years, with the best results in ages between 30 to 39 years.

Conclusion: Canines give accurate results for age estimation and they can be considered a useful tool for aging adults. The two methods examined in this study seem to be more accurate in ages between 30-49 years. The Lamendin method seems to be more accurate in ages under 40 years and the Prince and Ubelaker method in ages over 40 years. In general, both methods perform well and the differences between them are minimal.

***KEYWORDS*:** Forensic Odontology, Age estimation, Lamendin, Ubelaker.

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RADIOGRAPHIC TEST FOR AGE ESTIMATION WITH FORMULATION TOOTH CORONAL INDEX (TCI) IN RANGE OF AGE 9-21 YEARS

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The authors declare that they have no conflict of interest.

***Background**: The age estimation of living individuals is very important in cases such as age fraud in sports, inheritance rights, and child custody, where such cases often occur at the age of 9 to 21 years. The study was conducted to determine whether the estimated ages of 9 to 21 years old can be determined from radiographic analysis of pulp chamber with TCI method.*

***Methods**: Radiographs were taken from 148 men and women with a mandibular premolar teeth normal at age 9 to 21 years who came to the Clinic of Radiology, Clinic of Orthodontic, and Special Pavilion of Teaching Dental Hospital at Faculty of Dentistry Universitas Indonesia. Crown height (CH) and crown pulp chamber height (CPCH) were calculated using analysis Tooth Coronal Index (TCI).*

***Results**: There were significant differences between the age of the TCI analysis ($p < 0.05$) with specific prediction equation.*

***Conclusion**: Formulation of TCI-Benindra method can be applied to estimate the age of 9-21 years.*

***KEYWORDS*:** Forensic Odontology, Age estimation, Tooth Coronal Index.

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THIRD MOLAR DEVELOPMENT STAGING: CROWN-ROOT LENGTH RATIO AS REFERENCE FOR OPTIMALLY STAGING ROOT DEVELOPMENT

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The authors declare that they have no conflict of interest.

Multiple tooth development staging techniques were reported, based on the described and considered borderlines between succeeding stages. Anatomic tooth features or predictions of future tooth part dimensions are used to identify the thresholds between the established stages. The need to estimate completed tooth part dimensions in the latter is seen as a drawback to use this staging technique for age estimations. Searching the overall ratio between the crown and root length provides a tool for undisputable staging third molar root development with the technique based on future tooth parts.

The aim of this study was to measure the crown and root length of fully developed third molars and to calculate their ratio, enabling to consider the observed root length as a proportion of the already completely developed crown length.

On a sample of 1000 dental panoramic radiographs, the root and crown lengths of all present third molars were digitally measured using image ameliorating software (Adobe® Photoshop®, Adobe Systems Incorporated, San José California, United States America). The radiographs were collected from the dental clinic files of the Katholieke Universiteit Leuven (Belgium). The included subjects were equally distributed in sex, and their age ranged between 22 to 40 years. Three landmarks were defined for standardized measurements, namely two occlusal planes, the cement enamel junction and the root apice(s). Ratios of crown root lengths were statistically evaluated related to gender, and third molar position. After 1 month 100 panoramic radiographs were selected randomly from the main sample and the landmark setting and measurements were repeated to measure observer reliability.

An overall crown-root length ratio of 1/2.1 (0.48) was detected. As such, in case of doubt during third molar root development staging, the observed root length can be measured and related to the measured crown length for uniform classification. (e.g. an observed developing third molar with measured crown length 8.40 mm will have on average a completed root length of 17.64 mm,

implicating that a measured root length bigger than 4.41 mm and smaller than 8.82 is classified as root ¼ completed).

***KEYWORDS*:** Forensic Odontology, Age estimation, Root Development Staging..

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THE LONDON ATLAS OF TOOTH DEVELOPMENT: A STEP FORWARD

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***Aim**: To develop a comprehensive, validated, evidence based, practical, user-friendly atlas of dental age estimation and compare its performance with two widely used atlases.*

***Methods**: Diagrams representing ages between 28 weeks in-utero and 23 years were developed (The London Atlas) based on the radiographic appearance of tooth development in 528 individuals aged 2-23 years and 176 neonates using the median stage of tooth development for each tooth in each age category/chronological year. Accuracy was determined by ageing skeletal remains/radiographs of 1514 individuals (aged 32 weeks in-utero to 23 years) using The London Atlas (LA), the Schour and Massler (SM) and Ubelaker (Ub) atlases. Estimated age was compared to real age. Bias, absolute mean difference and proportion of individuals correctly assigned by age were calculated. Intra-observer variation (Kappa) was measured by re-assessment of 130 radiographs. To test the application of the London Atlas, a questionnaire was used to validate its use. Ninety 3rd year dental students were divided randomly into three subgroups, and blinded from the researcher. Each group used one of the 3 atlases to estimate the radiographic age of 6 individuals and complete the questionnaire. To take the London Atlas a step further, a decision to develop an interactive software computer program was taken using the data sheets of median stages of tooth development and all hand illustrations of tooth formation (appendix 10). The software program was designed to have three sections: (1) Playback mode to feature dental development for males, females and mixed sex covering all age ranges present in The London Atlas (31 age categories). (2) Data entry mode to feature a dental age calculator that enables the user to enter data for tooth formation and eruption according to Moorrees et al. (1963b; a) and modified Bungsten's stages (Bengston, 1935; Liversidge and Molleson, 2004). (3) Comparison mode to allow the user to compare tooth/teeth development between two different ages from the same sex or between different sexes at the same age.*

***Results**: Excellent reproducibility was observed for all three atlases (Kappa: LA 0.879, SM 0.838 and Ub 0.857). LA showed no bias (P=0.720) and correctly estimated 53% of cases. SM and Ub showed significant bias by consistently underestimating age (P=0.026 and P=0.002) with 35% and 36% correctly estimated for SM and Ub respectively. The mean absolute difference for LA (0.72 years) was smaller than SM (1.15 years) and Ub (1.17 years).LA was preferred over the other two atlases in all quality measures tested (clarity, design, simplicity and self-explanation).*

***Conclusion*: The London Atlas represents a substantial improvement on existing atlases facilitating accurate age estimation from developing teeth. Development of interactive online and mobile app versions is complete.**

***KEYWORDS*:** Forensic Odontology, Age estimation, London Atlas.

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THE IMPORTANCE OF FORENSIC ODONTOLOGY TO INTERPOL

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There are usually perceived and real problems and attitudes when Forensic Odontology and Policing rub shoulders. These problems exist at a Local, National and International level. What are the problems and are we currently responding appropriately to our role in DVI? Do we bite our tongues or become more proactive?

***KEYWORDS*:** Forensic Odontology, Mass Disasters, Interpol, DVI.

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THE TECHNOLOGICAL ADVANCES IN FORENSIC ODONTOLOGY

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The authors declare that they have no conflict of interest.

The DMORT teams that exist in the USA are an exemption that has no real counterpart in other parts of the world. In many countries the disaster victim identification organisation is put together ad hoc when the fatal event occurs. Among the disciplines involved in the identification effort the forensic odontology seems to have the least official affiliation in spite of its fundamental contributions to the establishing of identity. Subsequently, there's often little involvement of the proper agencies in the developing and modernisation of the equipment and facilities to suit and enhance the forensic odontologists' working situation. That is ultimately left to the individual forensic odontologist with whatever means that are available, presenting financial problems as the forensic odontology quite often is a sideline occupation for odontologists in academia or in private or community practice. Since their services are required infrequently it has not been possible to consistently develop the technology needed in the identification work, especially when large efforts are necessary in cases of mass disasters. The odontological identification work requires quite a lot of instrumentation, including x-ray machines as well as the radiographic reception media and very good illumination. All these devices have been traditionally gathered and/or built by the forensic odontologist, comprising among other things "home-made" portable x-ray machines on tripods, which would fall and break all too easily, portable "dark-rooms" for developing analogue radiographs, headlamps and flashlights. All these things were heavy, cumbersome and generally difficult to haul around as well as unreliable.

However, during the last decade the technology of the forensic odontology has gone through a dramatic progress diminishing the amount of equipment that has to be moved by about 75 % in volume as well as in weight. Since the combined international effort in identification of the Dec. 26, 2004 Bengal Bay Tsunami victims, there has been a swift innovation in the field of the forensic odontology.

The portable x-ray machine has become a handheld device that works on batteries. Also, replacing the analogue radiographs with digital radiography has reduced both the time needed for obtaining good quality radiographs as well as the quantity of machinery. A battery operated intraoral lamp that can be placed inside the oral cavity will provide bright lighting. Another common feature of these devices is that they can run on batteries for several hours making the forensic odontologist independent of external power supplies for at least a working day at a time.

There is however the drawback of the costs of these devices prohibiting many of the forensic odontologists from acquiring them. Neither the policemen nor the pathologists have to pay for their equipment.

Conclusion: In order to improve the ability of the forensic odontologists to carry out their part of the identification process the concerned national authorities should be encouraged to obtain the modern equipment needed. Another advantage would be that compatible pieces of equipment can be assembled.

***KEYWORDS*:** Forensic Odontology, Mass disasters, DVI.

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DEPLOYMENT OF NORWEGIAN DVI-TEAM AFTER TERROR ATTACK IN ALGERIE 2013

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The authors declare that they have no conflict of interest.

***Background**: The Norwegian DVI-team, formed in 1975, have responsibility for identification of Norwegian citizens who die in accidents at home or abroad. In January 2013 an oil installation at In Amenas, Algeria, was attacked by terrorists and more than 30 foreigners were killed among them 5 Norwegians. The DVI-team was asked to assist the Norwegian Embassy in Algers with the identification of the Norwegian victims.*

***Methods:** The presentation will evaluate dental equipment, transport, access to bodies, facilities for examination and integration and use of forensic odontologists in the DVI-team.*

***Results**: The prepacked DVI-equipment was in large metal containers which were too heavy for transport as luggage and had to be sent as diplomatic cargo. This was a disadvantage as the equipment for forensic examination arrived several days after the DVI-team. All necessary equipment, including the dental handheld x-ray machine were sealed by the Foreign Office as diplomatic goods and this simplified entry and passage through Algerian custums.*

In the beginning access to and examination of the bodies was restricted, but after a short time international groups were formed under the supervision of the Norwegian DVI-team and the British counter terrorism command (SO15). Despite delegations from many countries there were only two dentists, both from Norway. The working conditions were simple and lighting especially for dental examination insufficient. One power socket in the examination room restricted the use of electrical equipment and simple aids like extension leads, adaptors and extra light sources would have been useful. The portable X-ray machine was good and efficient, and digital post mortem pictures an advantage as retake was easy.

Dental AM-material included dental records from UK, Japan and Malaysia, but only the Norwegian records had been transferred to the Interpol form. The x-ray quality varied from digital radiographs which were downloaded on computers or Ipads to poor quality photocopies but all comparison could be made in the mortuary. This greatly speeded up the identification. For the Norwegian citizens the Interpol forms were filled in but for the UK and one of the Malaysian citizens letters explaining the findings were written to the coroner. The bodies were released by the Algerian authorities when the DVI-team's findings corresponded with the manual DNA-

comparison from the Algerian forensic team and accepted by the individual national authorities and families supported by documentation from the forensic team.

Conclusion: The forensic odontologists made a substantial contribution to the identification of the victims aided by prepacked instrument-kits and tools. Transport as diplomatic courier was a great help. When a DVI-team is deployed in a foreign country they are guests in that country and their work is to aid the national forensic team.

***KEYWORDS*:** Forensic Odontology, Mass disasters, Terror Attack, DVI.

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THE DENTAL FORENSIC DATA SUPPLEMENT TO ANSI/NIST-ITL 1-2011

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The authors declare that they have no conflict of interest.

Forensic odontology comparison software utilizes numerous dental descriptors and advance sorting algorithms to create a ranking of possible matches. Dental identification is based on similarities and differences of individuals, based on these descriptors, as well as supporting biometric and familial radiographs and visual information. Unfortunately, different forensic odontological software packages utilize different coding schema of varying degrees of granularity, specificity and ambiguity which makes the electronic transfer of this data between systems difficult.

In October, 2006, The American Dental Association (ADA) Standards Committee on Dental Informatics (SCDI) Joint Working Group 10.12 on Forensic Odontology Informatics was formed with a mandate of creating a standardized data dictionary of harmonized terms and definitions necessary to adequately serve the Forensic Odontology community. In 2010, the American National Standards/ American Dental Association Specification No 1058 Forensic Dental Data Set (ANSI/ADA Spec 1058) was published.

The ANSI/ADA Specification 1058 consisted of six antemortem standardized nomenclature data sets and four postmortem sets. From the onset, the goal of the ANSI/ADA Spec 1058 was not to define the extent of information collected, but to be certain that that there is no ambiguity in the meaning of common terms used to aid in human identification.

At the 2011, at an ANSI/NIST-ITL workshop, a proposal was presented by the Government of Argentina to create a new ANSI/NIST-ITL record type (Type-12) that would define a standardized electronic transmission of ANSI/ADA Spec 1058 information to all compatible software. The Dental Working Group of ANSI/NIST-ITL was established and over the next two years held several meetings to various audiences interested in forensic dental data. The Working Group met major dental data systems owners and developers and potentially affected stakeholders to make certain that their data transference criteria were met.

The proposed dental supplement, based on ANSI/ADA Standard No. 1058, primarily focuses on the use of dental data for identification of human remains when an unknown human decedent or living amnesic is encountered by law enforcement. The Supplement also allows for the exchange of data and images of suspected patterned injuries of intraoral origin as well as other biometric information latent image of possible perioral origin. The standardized data dictionary for this data set will be included in a future ADA Technical Report No. 1077 for Dental Biometric Descriptors.

The ANSI/ADA Spec 1058 provides a coherent and consistent manner of describing teeth and oral conditions and other data necessary to perform a forensic dental comparison. The ANSI/NIST ITL dental supplement facilitates the exchange of information and promoted system interoperability by defining the XML format and coding rules. Together the two standards facilitate the exchange of data to law enforcement agencies and forensic odontological management systems that may use different data storage and/or matching systems.

***KEYWORDS*:** Forensic Odontology, Mass disasters, Dental Standardized Nomenclature.

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INTRODUCTION OF NEWLY DEVELOPED SOFTWARE FOR IDENTIFICATION NAMED "MASS ID MANAGER(MIM)": FOCUSED ON ITS DENTAL MODULE

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The authors declare that they have no conflict of interest.

When forensic professionals are dealing with mass disaster victims, the volume of postmortem and antemortem data is sometimes too large to collect and compare. In that case, performing identification with computer software makes the process much faster and more efficient. There are many systems are used recently, for example, DAVID, WinID3 and DVI System International^{R}. Among them, DVI System International^{R} is widely used in many countries and even hired official system in Interpol. However, the price of DVI system international^{R} is too expensive (over than 100,000 euro, excluding maintenance fee) and most developing countries cannot use this system. Even in case of Korea, purchasing the system was approved by the government not until 2012.

Therefore, the Korea DVI had a decision to develop a new software named "Mass ID Manager(MIM)" especially focused on small to medium sized disaster and have a plan to distribute to member countries of APMLA(Asia-Pacific Medico-Legal Association).

In developing the system, we consider the possibility of compatibility with DVI System International^{R} and develop many new modules like fingerprint, anthropology and familial assistance modules. For dental module, the matching algorithm is based on the number of matching points. The matching point is divided into two categories, complete and partial matching point that should be appeared discriminately in comparison process. The coding system of dental characteristics is newly designed for this system. For enhancing the intuitive nature of codes, we abandon 3-digit codes which are used in DVI System International^{R}. The user interface is designed to enhance convenience in identification process.

The purpose of this presentation is to introduce Mass ID manager system especially of its dental module. The result of simulation of identification will be presented with the real ID case which was already presented in former 2010 IOFOS meeting.

Since, MIM is still undergoing construction, the idea of improvement and modification from the member of IOFOS is urgently needed for making better software for identification.

***KEYWORDS*:** Forensic Odontology, Mass disasters, Software, Dental Module.

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THE EVOLUTION OF DENTAL PARTICIPATION IN DISASTER VICTIM IDENTIFICATION IN THE UNITED STATES

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The authors declare that they have no conflict of interest.

Dental identification has been used and accepted in the US since the 1776 identification of the remains of Gen. Warren by a dentist. Since then dentistry has played an important role in identifying victims of natural disasters, accidents, terrorist activity, and war-related incidents. Forensic dentistry has proven itself a rapid, reliable, economical, and scalable resource, and now has undertaken a similar role in the investigation and identification of victims of serial killers, genocide, and the ever-growing number of missing persons and unidentified bodies.

A fundamental difference between these types of operations is the proximity (or lack thereof) of the victims temporally and geographically which highlights a shortcoming of information management – independent of the time frame or methodology. While communication between the traditional antemortem, postmortem, and comparison sections in dental identification are generally time and location constrained; communication between these entities becomes problematic as distance increases in space and time. Adoption of computer-assisted dental identification programs has lessened some problems but has exacerbated others.

The generally thought-to-be-beneficial ability to capture and compare more detailed postmortem data also introduces chances for improper coding yielding incorrect exclusionary reports, while also increasing CPU needs and processing time. Although many forensic dentists consider a case closed upon rendering an opinion of identification (or exclusion), the dental data can also be useful to other personnel in the investigation / incident; however, for that to occur understandable dental data must be able to be transferred. The American Dental Association in cooperation with the National Institute of Standards and Technology has developed a data dictionary and exchange format to standardize such transmissions. SWGDVI, which enjoys international participation, is working to develop best practices to ensure that forensic dentists can not only continue to make identifications, but be able to share needed dental data with other team members.

***KEYWORDS*:** Forensic Odontology, Mass Disasters, Computer-Assisted Identification.

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TECHNOLOGICAL ADVANCES IN DENTAL VICTIM IDENTIFICATION

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The authors declare that they have no conflict of interest.

***Background**: Victim identification, from a dental perspective, is primarily a pattern recognition and comparison exercise. However situations occur that may preclude the forensic odontologist from applying direct comparison techniques. These include inadequate quantity or quality of the post-mortem evidence. This can result from extreme trauma, fragmentation or incineration. Another factor may be the lack of adequate ante-mortem information. This could result from lack of, inability to locate, quality, or age of the dental record. Any one of the above circumstances, post-mortem or ante-mortem, could preclude the odontologist from establishing a positive identification though image pattern comparison or even the less desirable or reliable: positive dental treatment record correlation, either through narrative or odontogram comparison.*

This presentation will discuss three separate techniques and applications of technology, which can be useful under extreme conditions for forensic dental identification. The specific technologies are: Scanning Electron Microscope/Energy Dispersive x-ray Spectroscopy (SEM/EDS)X-ray Fluorescence spectroscopy (XRF)Computer aided design and computer aided manufacturing (CAD/CAM) restorative or orthodontic systems

***Method**: SEM/EDS allows for evaluation of not only the microstructure of a tooth or dental material but also the elemental composition. The specific elemental composition of a particular dental material may provide another level of certainty to establish a positive dental identification. Application of this technology to fragmented, incinerated remains in an airplane crash provided additional information useful to the dental identification team. The analysis not only confirmed the presence of endodontic therapy but more specifically the brand of root canal sealer used in treatment. This identification of the material was verified by accurate notation in the dental treatment record. Therefore, although the post-mortem material was of poor quality and quantity, the microscopic technology and quality ante-mortem dental record provided useful information to counter that deficiency. An added benefit of this technology is the fact that incineration does not preclude use. As opposed to the laboratory based SEM/ XRF provides a portability component and therefore can be used in the field or a morgue setting. It also allows*

for analysis of both large and small specimens with no specimen preparation required. XRF provides a "point and shoot" analysis with direct data base comparison. Studies have shown that restorative composite dental materials have identifiable elemental compositions in type and quantity. In cases where teeth with composite dental restorations are charted an elemental analysis may significantly increase reliability of identification. An individual tooth, with multiple restorations of different manufacturer brands, or multiple brands in variant sequences in the oral cavity, significantly increases the information available for comparison. The material is no longer identified as simply a composite resin but a specific material in a specific pattern or sequence and therefore increased variance for identification. This application is of course dependent on accurate record keeping that specifically documents the manufacturer brand in the dental record. Aside from dental material identification, technology has also provided the forensic odontologist with another form of a dental patient record. This does not refer to digital records or radiography associated with the "paperless" office. Digital restorative dentistry and orthodontic or splint therapy have established CAD/CAM databases of retrievable, reproducible dental information. This information can be recovered from dental laboratory or dental offices computer systems. These three dimensional (3D) models can be used to be compared directly to postmortem remains or recovered dental materials.

Results/Conclusion: Examples of all of the above technologies, as applied to specific cases and situations, will be presented in order to educate the forensic dental community and increase awareness of these innovative approaches to forensic dental identification.

***KEYWORDS*:** Forensic Odontology, Mass Disasters, Identification, SEM.

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INSERTION OF CRANIOFACIAL X-RAY FILES IN THE INTERPOL NOTICES : FROM THE PRESENT TO THE FUTURE ; A NEW WAY OF THINKING

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The authors declare that they have no conflict of interest.

The development of the couple aims-results has made an efficient and well-known tool from Interpol Notices all over the world. The gradual integration of reliable and experienced identification items has decisively contributed to obtain positive results matching police requests. Inside Interpol Notices, each of the four criteria usable to identify a person has its own limitations. Their potential combinations are supposed to lead to a positive identification. Nevertheless, in some rare but real cases, a fifth criterion is lacking.

The purpose of this work is to submit a easy, proven, progressive solution which can be used everywhere in the world. This fifth criterion is at the junction of anatomy, anthropology and dental orthopedics clinical practice. Proceedings, comments, notes and evolutions observed in the bosom of Interpol DVI Odontologic sub-working group for several years reinforce us to develop this new criterion.

***KEYWORDS*:** Forensic Odontology, Interpol, X-ray.

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MASSIVE DISASTER MANAGEMENT IN ARGENTINA: PERSONAL EXPERIENCE

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The authors declare that they have no conflict of interest.

In Argentina there have been far more events involving multiple victims. Forensic dentistry was able to contribute with a high incidence in the identification of victims of mass disasters such. The purpose of this paper is to present how they were carried out the work of identification from dental methodology and the problems that the team had to face. Each of these events has demanded different work methodologies given the conditions in which showed the bodies and threw different results depending mortem pre existing documentation. The most known and their statistics:

A.M.I.A., Buenos Aires, July 1994. 84 fatalities product of a bomb attack, was achieved by 47% of dental identification.

Military Helicopter Crash Argentine polo field, Buenos Aires, October 8, 1996, 10 fatalities charred, achieving 100% in dental identification.

LAPA, Buenos Aires, plane crash, off plan fails and the ship collides with a sparkling mound causing it to catch fire quickly. 67 fatalities charred 32% of dental identification, with some cases of adulteration identification crosslinking in dental Medical Records.

SOL Crash, May 18, 2011, ship icing that falls crashing in the steppe of the province of Rio Black, 22 fatalities with great dismembered bodies. 1% dental identification by lack of data on dental history.

They have produced so far 30 events involving multiple victims. Forensic dentistry was able to contribute with a high incidence in the identification of victims. The purpose of this paper is to present how carried out identification work from dental methodology and problems team faced.

***KEYWORDS*:** Forensic Odontology, Mass Disasters, DVI.

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COMPUTERIZED DENTAL CODING AND SORTING ALGORITHMS: IS THERE A BEST?

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The authors declare that they have no conflict of interest.

For many mass fatality incidents, dental comparison serves as a primary means of victim identification. Software packages such as Plass Data's DVI System, WinID3 and UVIS/UDIM use software algorithms to provide Forensic Odontologist with an objective "best-match" tool from which to undertake a more in-depth review of the dental records. The role of computer ranking programs is to compare antemortem and postmortem records and quantify the number of matches, mismatches, and possible matches between records. The computer then ranks the various records based on a sorting algorithm (e.g., most matches followed by least mismatches). Within the field of forensic odontology there is no universally agreed upon coding system that is used for documenting tooth conditions. In addition, although many different sorting algorithms exist there has been no true controlled study to see if a single algorithm will work well in multiple situations (e.g., mass fatality incidents (MFI), national missing person's databases, and low and high fragmentation incidents). The goal of this research is to compare the effects of coding granularity (i.e., detailed

codes versus simple codes) as well as multiple ranking algorithms. This analysis was performed with a new simple coding system and concurrent optimized ranking algorithm being tested at New York City's Office of Chief Medical Examiner (OCME).

For this study, a large sample of adult dental data was compiled from numerous United States National Health and Nutrition Examination Studies (NHANES). The available data consist of approximately 35,000 records. These databases allowed the controlled changes in order to test different coding and ranking methodologies. To explore the effect of various levels of coding discrepancies, the database were modified to reflect various rates of coding discrepancies, fragmentation types and size of the incident or database. In addition, tests were performed on dental data from three actual MFIs (World Trade Center, AA Flight 587, and USAir Flight 427).

Currently MFI odontology management software is based on a high degree of granularity; following the concept that "more is better" with respect to coding. More detailed codes imply a greater level of precision in documenting the dental status and, potentially, greater accuracy in the resulting ranks. In addition, highly granular data offers the ability to perform "focused" searches. The potential pitfalls of detailed coding may include data entry errors, lack of compliance/understanding, and a slow/tedious charting process. The important consideration for computerized ranking is to utilize a coding format that provides the best results with the least amount of effort.

The data were analyzed using the algorithms for Most Dental Hits and Least Dental Mismatches as well as OCME's optimized ranking algorithm. The comparisons were done using WinID's detail coding as well as OCME's simplified coding format. Databases simulating different incident sizes and degrees of fragmentation, as well as the real world MFI data, were tested. In all cases, OCME's optimized ranking, using either the detail or simplified coding, outperformed commonly used algorithms. When using the optimized ranking algorithm, differences between detail and simple coding were only seen in very large, highly fragmented simulations.

***KEYWORDS*:** Forensic Odontology, Mass Disasters, Software, Plassdata, WinID.

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DVI PROCESS IN FEBRUARY 2011 EARTHQUAKE IN NEW ZEALAND

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The authors declare that they have no conflict of interest.

The city of Christchurch is New-Zealand's second largest city with a population of 376,000. It is situated on the East Coast of the South Island and serves as a gateway for Tourists, Overseas Visitors & New-Zealanders coming to the South Island. On February 22nd 2011 a devastating Earthquake struck at 1251 hours, causing catastrophic damage to the infrastructure of the city with the loss of 185 souls. This paper reviews the response to this event, the establishment of a field mortuary and the D.V.I process employed. This process was unprecedented in New-Zealand. The emotions of the presenter are described, especially with regard to experiencing the event, along with the following two and a half years of ongoing aftershocks. Some 13.000 aftershocks have been recorded/felt since the 7.1 Quake of September 2010 to May 18th 2013. Of this number 5000 have been magnitude 3 or more on the Reichter scale.

The presenter was in the unique position of experiencing the February quake, endeavoring to resume a normal day to day family lifestyle, restore a Periodontal Practice and, cope with the ensuing stresses whilst also being intensely involved with the development and operation of the D.V.I process.

***KEYWORDS*:** Forensic Odontology, Mass Disasters, New-Zealand Earthquake.

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A NEW WEBSITE TO AID THE INTERPRETATION OF ANTE-MORTEM DENTAL RECORDS: WWW.INTERNATIONALDENTALCHARTS.COM

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The authors declare that they have no conflict of interest.

***Background**: The INTERPOL (International Police Organization) Disaster Victim Identification forms represent a global standard for mass disasters and the collection of international ante-mortem dental records. These records can now be interpreted more easily with the help of a new online dictionary of dental terminology for translating dental charts from several languages into English. The free website launched in 2013 (www.internationaldentalcharts.com) is a result of my M.Sc project on international dental charts completed in 2011: Guide of International Dental Charts translated into English –- decoding international ante-mortem dental charts for INTERPOL's Ante-mortem (AM) Disaster Victim Identification (DVI) forms (Section F2).*
The aim of this study was to analyse the tooth numbering system, symbols and abbreviations used on dental charting worldwide. A letter was sent to the national dental associations of the 188 NTERPOL member countries, addressing the goals of the project and asking for samples of dental charts.
***Results:** A total of 44 countries replied and 32 common dental alterations were selected for translation, such as decay, filling and extraction. Their symbols and/or abbreviations used were summarised in 10 languages. More than one system of dental notations was used in the same country whereas there was an absence of standard systems in other countries. Some of the samples of charts received were of little value. However, a fair amount of useful information and detail was found in most of them.*
***Conclusion**: This free consultation website could be useful when the handwriting, symbols and abbreviations on the ante-mortem dental charts are not clear. It will be particularly useful when ante-mortem X-rays and casts are not available.*

KEYWORDS: Forensic Odontology, Mass Disasters, Website.

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I-O-F-O-S

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2012 SUKHOI SUPERJET 100 CRASH: INTEGRATED VICTIM IDENTIFICATION

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The authors declare that they have no conflict of interest.

Sukhoi Superjet 100 (SSJ-100) crash occurred on 9 May 2012 when an SSJ-100 aircraft crashed on a joyflight operating from Halim Perdanakusuma Airport, Jakarta, Indonesia. All 45 passengers and crew onboard were killed, consisted of Indonesian, Russian, American and French citizens. Of the human remains recovered, all positive identifications were made, fourty four of the identifications were by primary identifiers and one by secondary identifier.

This paper describes the disaster victim identification operation of SSJ-100. The authors were members of Indonesian National DVI Team deployed for 15 days operation in Jakarta to assist the Indonesian authorities in human remains identification.

***KEYWORDS*:** Forensic Odontology, Mass Disasters, Indonesian DVI Team.

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THE DEPIGMENTED "WHITE BITE MARK" OBSERVED IN DARK-SKINNED INDIVIDUALS: TWO CASE STUDIES

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**Two terms President and current Vice-President of IOFOS - Private dental practitioner and part time senior Stomatologist in the Department of Oral Pathology and Oral Biology, University of Pretoria, South Africa. M.Sc. (Odont) cum laude in Oral Pathology, Dip. Odont. cum laude in Forensic Odontology. Ph.D in Forensic Dentistry. He lectures in Oral Pathology and Forensic Dentistry, and is manager of Forensic Dental Research. Since 1998 he has acted as forensic consultant during which time he has been involved in all aspects of Forensic Dentistry. He regularly acts as expert witness in Supreme Court cases involving tooth marks. He has attended courses/delivered papers related to forensic odontology, and has published internationally. He is a member of the Editorial Board of the Journal of Forensic Odonto-Stomatology.*

The authors declare that they have no conflict of interest.

ABSTRACT

Depigmented bite marks observed in dark skinned individuals can be of value in forensic investigations. The ageing of bitemarks is controversial, and no universally acceptable guidelines are presently available which accurately predict this complex process. The presence of both a newly inflicted and a depigmented "white bite mark" in a victim indicates a time interval between the biting incidences. Skin is an organ of the human body capable of healing when injured. The repair process leaves tell-tale signs at both the macroscopic (visual) and microscopic (histologic, histochemicaland biochemical) levels. The depigmented "white bite mark" clearly demonstrates a trauma-induced absence of melanocytes and an associated absence of melanin within the epithelium. This process is not unique to bite mark injuries but observed in general trauma, freeze burning and following application of skin lightening creams. Two cases will be discussed, showing visual images of the depigmented bite marks as well as the histological assessment of the affected tissue. The observation of a re-epithelialized depigmented bite mark indicates an interval of at least 5-days following injury.

***KEYWORDS*:** Forensic Odontology, Bitemark, Depigmentation

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3D imaging for bite mark analysis – presentation of a new approach

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The authors declare that they have no conflict of interest.

Background: In recent years the forensic analysis of human bite marks has been subject to increased scrutiny and a number of authors have presented case examples where incorrect bite mark evidence at least in part has contributed to wrong convictions. Consequently a paradigm shift in the analysis of bite marks towards a much more cautious and scientifically based approach to the use of bite mark analysis methods has been seen. The need for methods reducing errors when capturing the complex details of curved and often distorted lesions in soft tissues has been emphasized. Preliminary reports on the use of objective, digital and multiple-dimensional methodological approaches are emerging.
Method / Results: Experimental bite marks were scanned with a Creaform GoScan (Creaform, Quebec, Canada) after placing 4 adhesive reference labels adjacent to the bite marks. Scans were taken with and without the ABFO no. 2 scale. The full dentitions of the "suspects" were scanned with a Trios intraoral scanner (3Shape, Copenhagen, Denmark) and digital 3D casts of the dentitions were generated with 3Shape Ortho System software. Datasets of the 3D bite mark scans and the digital casts were combined by a newly developed customized software (Kvejborg, Denmark) allowing digitalized measurements of linear and angular features in the casts and soft tissue scans as well as 3D visualizations of physical fits between casts or segmented casts and 3D bite mark scans in a 1 : 1 scale. The method allows 3D printing of the anatomical site including the bite mark which in certain cases may be useful for the presentation of a crime case. The application of the multidimensional digital approach is exemplified by the presentation of a recent homicide case involving bite marks.
Conclusions: By applying multidimensional digital applications objective data on minute details, in bite marks and in the suspects dentition, can be obtained and compared more objectively than was possible with the formerly used methods which converted multidimensional complex features of bite marks as well as dentition details into 2D overlays for comparative analysis.

***KEYWORDS*:** Forensic Odontology, Bitemark, 3D imaging.

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COMPARATIVE ANALYSIS OF LIP AND FINGER PRINT PATTERNS FOR SEX DETERMINATION

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The authors declare that they have no conflict of interest.

Fingerprint evidence, is undoubtedly the most reliable and acceptable evidence for individual identification, till date, in the court of law. Finger print patterns are also used for gender identification. Cheiloscopic prints are also used for gender identification, however, unlike fingerprints, unanimity still does not exist between investigators to accept cheiloscopy as a method of gender identification.

Aims: Determination of sex of an individual from (1) lip print patterns, (2) finger print patterns and (3) comparison of the two methods in sex determination.

Methodology: Lip prints and finger prints of left thumb were obtained from 89 (43 males and 46 females) subjects included in the study. The lip prints were analysed according to Vahanwala et Al. classification and finger prints were analysed according to the results by Patel Z et al. The predicted genders were compared with actual genders of all the subjects. The results were statistically analysed.

Results: Lip print analysis had higher specificity (69.6%), positive predictive value (68.9%) and negative predictive value (72.7%) for gender identification over finger prints.

Discussion & Conclusion: Finger print analysis is accepted as evidence in courts of law, while cheiloscopic evidence is not. However, in instances where only dermatoglyphic pattern recognition is feasible, our study shows that gender identification from lip prints is more reliable than from finger prints. Thus our study emphasizes the importance of cheiloscopic evidence for sex determination in forensic odontology.

***KEYWORDS*:** Forensic Odontology, Lip print, Sex determination.

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EXPERT INTERPRETATION OF BITEMARK INJURIES

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The authors declare that they have no conflict of interest.

Disagreement between experts is one of the most difficult situations faced by judges and juries when deciding whether to accept or reject expert evidence, and consequently answer the ultimate question of guilt or innocence. Analysis of the sources of disagreement in bitemark injury interpretation is useful to the forensic odontology community in that it can direct appropriate interpretations along the bounds of what is scientifically valid as well as what views are consistently held by the expert community. This study attempted to characterise the nature of disagreement amongst odontologists in determining the fundamental properties of suspected bitemark injuries. 15 odontologists were interviewed face-to-face with the principle author and asked to freely comment on six images of supposed bitemarks. Interview participants were shown six images of bitemarks, all of them taken from actual casework presented to one odontology centre in Australia. They were asked to assume that these were photographs given to them by an agency for their initial comments. No contextual information was given to participants, and they were free to express as much or as little opinion as they liked regarding the image before them. Qualitative analysis using a grounded theory approach revealed that practitioner agreement was at best fair, with wide ranging opinions on the origin, circumstance and characteristics of the wound given for all six images. Expression of whether the injury represented a bitemark was generally expressed in one of five categories, ranging from weakly negative (probably not a bitemark) to strongly positive (definitely a bitemark), yet there was considerable variation in opinions about the same image in this regard. Other common areas of discrepancy included the supposed orientation of the bitemark, the significance of central ecchymosis associated with the injury, and whether or not the injury was suitable for further analysis. More experienced practitioners (> 10 years) agreed with each other less than those who had 10 years or less experience in forensic odontology. There was no clear or consistent pattern to agreement or disagreement between any of the 15 odontologists: some practitioners whose comments were in agreement regarding one image were in complete disagreement concerning another, but nor was this consistently the case for any given odontologist pair. Odontologists were also asked to rate the quality of the bitemark injury in accordance with a published significance and severity scale. Some issues noted with odontologists' application of this scale include its application in the absence of pictorial examples, and its application to injuries that were older. The highest level of agreement in expression of the origin of the injury between odontologists was reached when the quality of the injury was poor, in that odontologists tended to agree most when there was uncertainty, as opposed to the lower level of agreement seen when more definitive opinions were expressed. The differences in opinions can be at least partly accounted for by the inconsistent nature of approaches used by different practitioners

in assessing bitemark evidence. Some practitioners used different criteria for assessing whether the injury was caused by teeth compared to other odontologists. The results of this study indicate that more definitive guidelines as to the assessment of bitemarks as patterned injuries should be developed in order to ensure the highest possible level of practitioner agreement.

***KEYWORDS*:** format times new roman

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CURRENT TRENDS IN BITEMARK EVIDENCE/ANALYSIS/COMPARISON: RESEARCH PERSPECTIVES

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The authors declare that they have no conflict of interest.

Bitemark evidence can be used in criminal proceedings to analyze and compare suspected populations of biters with bitemarks seen in criminal events. Recent research publications regarding bitemark evidence have centered on two main areas: bitemark patterns in skin and the uniqueness of the human dentition. Has this research contributed to a better understanding of bitemark evidence, analysis and comparison in actual cases? Research publications attempting to study the bitemarks seen in the actual cases have centered on a cadaver or porcine skin model to artificially create tooth patterns in these skin substrates as an attempt to better understand the bitemark patterns seen in living skin in real cases. Scientific study necessarily requires that an investigator recreate the event seen in nature (bitemarks seen in living skin in acts of violent crime) and replicate that same event in a controlled environment to study and better understand the event seen in nature. This presentation will review the premises and methodologies for these artificially inflicted tooth pattern studies that have substituted cadaver and porcine skin for living human skin to see if this research satisfies the requirement for scientific study of bitemarks in living human skin. Additional research has been published attempting to determine if the human dentition is unique to an individual. Methodologies in these studies have centered on Procrustes Analysis of data points placed on digital images of models of human dentitions. Similar studies by different investigators have been published with diametrically opposite findings, one research group finding the human dentition to be unique and another research group finding dentitions so similar as to be indistinguishable. This presentation will review the premises and methodologies of these studies to attempt to determine how similar studies have such different findings.

***KEYWORDS*:** Forensic Odontology, Bitemark, Current trends

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CURRENT STATUS OF BITEMARK ANALYSIS IN THE UNITED STATES: LEGAL PERSPECTIVES

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The authors declare that they have no conflict of interest.

For the past 13 years, there has been a drumbeat of DNA exonerations involving bitemark evidence in the United States (US). Almost all of these exoneration cases were spearheaded by the Innocence Project. The Innocence Project was founded in 1992 by Barry C. Scheck and Peter J. Neufeld at the Benjamin Cardozo School of Law at Yeshiva University in New York to assist prisoners who could be proven innocent through DNA testing. To date, more than 300 people in the United States have been exonerated by DNA. Despite the fact that forensic odontologists played a crucial role in these wrongful convictions, forensic odontology also played a crucial role in challenging the bitemark evidence both before and after the appellate process. From 2000 until 2010, there have been approximately 10 DNA exoneration cases involving bitemark evidence in the US. In at least half of these cases, American Board of Forensic Odontology (ABFO) Diplomates were involved in challenging this evidence. In a few cases, ABFO Diplomates testified in the original trials and in others, they were involved in post- conviction review of the bitemark evidence. Because of these DNA exonerations, the United States Congress passed an appropriations bill in 2006, which authorized the US Attorney General to provide funds to the National Academy of Sciences (NAS) to create an independent committee to examine the following: 1) assess the present and future needs of the forensic science community; 2) disseminate best practices and guidelines on forensic sciences; 3) make recommendations for maximizing the use of forensic techniques; 4) make recommendations for increasing the number of qualified forensic scientists and medical examiners. In 2009, the National Academy of Sciences issued a report entitled "Strengthening Forensic Science in the United States: A Path Forward". In this report the NAS outlined their findings, including a critique of bitemark analysis in the US. Since this report was issued in 2009, there have been numerous challenges in the US to the admission of bitemark evidence in criminal trials, including a post- conviction challenge in Federal Court in Texas in 2011. This challenge resulted in the Court upholding the admissibility of bitemark evidence on appeal. These challenges come despite the long history of admission of

bitemark evidence in US Courts. Bitemark evidence was first introduced in court in the US in 1954. Since that time, the admissibility of this evidence has never been rejected by any US court. Nevertheless, because of the NAS report and numerous DNA exonerations involving bitemark evidence, there are currently 2 challenges to this admissibility. One of these cases has been decided and the other is awaiting a ruling by the court. If we examine the bitemark cases that resulted in DNA exonerations, there is a common theme that runs through all of them. In every case, the forensic odontologist rendered an opinion that was not supported by the evidence. In most cases, the linkage opinion went beyond what the evidence supported. In a smaller number of cases, the bitemark analysis itself was flawed. If bitemark evidence is going to withstand these legal challenges, careful case selection is essential. It is my opinion that bitemark evidence does have value if properly utilized. Proper utilization involves selecting cases that have sufficient evidentiary value. In short, bitemark evidence is most valuable when 3 conditions exist: 1) the bitemark has significant evidentiary value for analysis; 2) the potential biters have distinctly different dentitions; 3) the population of potential biters is limited (closed).

***KEYWORDS*:** Forensic odontology, Bitemark, Legal perspectives.

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ANALYSIS OF BITEMARKS IN FOODSTUFF BY COMPUTERIZED TOMOGRAPHY (CONE BEAM CT) - 3D RECONSTRUCTION

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The authors declare that they have no conflict of interest.

Background: *The methods of registration and analysis of bite marks have evolved through the technological advances. Nowadays, the evolution of those methods it's a priority.*
The tridimensional analysis of forensic evidence has become a highlighted procedure when compared to the traditional methods. This tridimensional analysis is based on the registration of the surface of the bitten object.The authors propose the study of the surface and interior of the bitten object by cone beam computerized tomography (CB-CT), which is used in dental practice. In this study, CB-CT is applied to the analysis of bite marks in foodstuffs, which may be found in a forensic case scenario.
Material and Methods: *Were used 6 different types of foodstuffs: chocolate, cheese, apple, chewing gum, pizza and tart (flaky pastry and custard). The food was bitten and dental casts of the hypothetical suspects were made. Tridimensional images of the dental casts and bitten objects were obtained using an x-ray source and the CB-CT equipment iCAT® (Imaging Sciences International, Pennsylvania, EUA). The software InVivo5® (Anatomage Inc, EUA) was used to visualize the images, measure its radiopacity at Hounsfield Units (HU) and to do the tridimensional analysis of the images.*
Results: *There were obtained DICOM images in axial cuts from all the material in study. For each type of food a set of HU values was obtained, which varied between 194HU and -749 HU. The chewing gum had the highest value of radiopacity and pizza had the lowest. In all the foodstuffs the bitemarks contours could be identified.*
Discussion and Conclusion: *The HU values attributed to each material allowed comparing the radiopacity of the foodstuffs and casts relatively to water and air. The HU intervals obtained for each material can be explained by its composition. The more heterogeneous and less compact is an object, the highest is its HU interval. The chewing gum, which is the most radiopaque (194 HU), has a well defined image; pizza (-171HU to -500HU) has a less defined image in what concerns the contours of the bitemarks. It was possible in all the foodstuffs to identify the teeth involved in the act of biting and to distinguish between the upper and lower dental arches. All the used materials were successfully reconstructed in three dimensional images. Through the axial cuts and tri-dimensional reconstruction it was possible to analyze the depth of the bitemark and dental arches.*
The method that we used, compared to the traditional methods of impression of the bitemarks in foodstuffs, allows a better registration of the evidence data. This is possible even in materials like the

custard of the tart, were it's not possible to use an impression material. In addition, in contrast to the impression methods, the CBCT is non-destructive, allowing the collection of DNA after the scanning of the object. Comparatively to the photographic methods, this technique added the third dimension. This allowed the tridimensional visualization of the object, obtained from the registration of its surface and interior. This method allows the correct registration of the entire biting surface, eliminating the distortion associated with the photographs. Furthermore, through the superficial and inner visualization of the object, it allows a rigorous analysis of the depth of the bitemark.
We can conclude that computerized tomography is an important tool for forensic sciences, namely for the registration and analysis of bitemarks in foodstuffs that may be found in a crime scene.

***KEYWORDS*:** Forensic Odontology, Bitemark, CBCT

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THE CURRENT STATUS OF BITEMARK EVIDENCE EDUCATION IN THE UNITED STATES OF AMERICA-2013

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The authors declare that they have no conflict of interest.

The education of dentists who plan to become forensic odontologists in collecting, managing, analyzing, and reporting bitemark evidence has evolved from being virtually non-existent when the first bitemark case was brought before the US court system in 1954 to its current status. Formal bitemark evidence education in the USA began in earnest only after forensic odontology was established as a branch of forensic science upon the formation of the Odontology Section of the American Academy of Forensic Sciences and the American Society of Forensic Odontology in the early 1970s and the American Board of Forensic Odontology in 1976. Conceptualized at the meetings of these groups, the pioneers of forensic odontology education organized short courses and symposia that included bitemark evidence instruction. Later, longer and more detailed instruction in the management of bitemark evidence became part of weeklong courses and ultimately a one-year and then two-year long fellowship in forensic odontology. The philosophy and the content of education courses in bitemark evidence also evolved from those early years. This evolution was and is, in part, a result of the natural maturation of a novel field, but without doubt, was also motivated by the need to add discipline, common sense, and appropriate science to a nascent field that was, in the opinions of many, prematurely thrust into the legal system. The changes both influenced and were guided by the evolving standards and guidelines published by the American Board of Forensic Odontology. This presentation details that evolution and documents the changes that have occurred in the USA in teaching the principles and methodology of managing bitemark evidence.

***KEYWORDS*:** Forensic Odontology, Bitemark, Education

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APPLICATION OF INCISE DENTAL SCANNER TO COMPARE BITE MARKS IN CHEESE WITH MODELS OF THE SUSPECTS' DENTITIONS

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The authors declare that they have no conflict of interest.

Analysis of a bite mark offers an opportunity to identify a suspect using the individual characteristics of the dentition. The main focus normally is analysing bite marks on the human body. However, bite marks in food have an important role in the investigation of crimes. Bite marks can be analyzed with three dimensional technology, 2-D photographic image comparison of a bite mark and models of a suspects's dentition. This analysis is challenging. This study presents a comparison of bite-marks and the dentations' of the presumed subject using a technique of producing 3-D images of the indented marks and the dentations. It aimed to develop an objective, quantitative and reproducible 3-dimensional technique using a contact type of scanner, Incise Dental Scanner (IDS), to match and compare teeth, free form surfaces and bite marks. A sample of 6 dental study models and their corresponding bite marks made by the same participants into cheese blocks (20×40×20 mm) with their 6 upper anterior teeth. were digitized by the IDS at 0.1mm scanning interval and a scanning speed of 500 points per minute. The data was analysed using Cloud software (UCL, UK) to perform 3-D free-form superposition and the differences of mismatch from subtracted images. The biting edges are usually the only clear feature in a bite mark and therefore, were selected as the reference frame for the comparison using superposition of the 3-D images between the corresponding model and bite impression. The match of the outline of the bitten edges with their corresponding models was demonstrated in a 3-D subtracted colour image indexed by colour coded map. The descriptive statistical differences between the two corresponding images revealed a high degree of fit, with average differences ranging between -0.6 and 0.9 µm and square root of mean between 11.1 and 11.7 µm. It was demonstrated that IDS and the software ''Cloud'' gave quantitative matching between bite marks on hard substrates and suspect's teeth outline. This, with the 3-D presentation of the evidence can be presented with degrees of certainties, thus avoiding observer bias.

***KEYWORDS*:** Forensic Odontology, Bitemark, Incise Dental Scanner

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ESTIMATIVE OF THE SEX IN SKULLS USING PHYSICAL ANTHROPOLOGY AND DNA

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The investigation of the sex is one of the most important analyzes in the human identification. This study aimed to determine the sex in human skulls using three methodologies of Physical Anthropology, two quantitative (Forensic Data Anthropology Bank, FDB, 1986 e Oliveira, 1995) and one qualitative (Walker, 2008) and genetic analysis by amelogenin. The sample was composed by 66 skulls (34 men and 32 women) from the Center for Study and Research in Forensic Science, Guarulhos, SP. The methodologies were applied by two researchers who were unaware of the cranium's sexes. For the statistical analysis, there were performed descriptive analysis, average, standard deviation, linear discriminant analysis and logistic and logistic regression. The quantitative methodology presented an accuracy of 89.52%. The FBD method had an accuracy of 92.31%, with the development of a mathematical model using the measures Bizygomatic breadth, Nasal heigh, which showed the biggest dimorphism between the sexes, and Basion-bregma height and Maximum Cranial Length. The Oliveira's et al. (1995) methodology required adjustment for the studied population (new formula with an accuracy of 76.47% in men and 78.13% in women). For the DNA, it was possible to determine the sex in 86.15% of the sample. The different methodologies behaved similarly and with high accuracy in sex determination. Physical anthropology has the advantages of being easy to use, reliability and low cost, but needs population adjustments. The DNA is more complex, requires specific reagents and structure and may have interference from environmental condition, however, does not need to be adjusted to the population.

***KEYWORDS*:** Forensic Anthropology, Gender estimation, DNA

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ADMISSIBILITY OF BITEMARK EVIDENCE IN MALAYSIA COURT: A CASE REPORT

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The authors declare that they have no conflict of interest.

***Background:** A 2-year old deceased boy was referred for forensic odontology examination and investigation by the forensic pathologist in-charge of the case in regards to an alleged bitemark injury over the upper right arm on Jun 2010. Subsequent examination and analysis confirmed that the injury which consisted of two sets of similar-looking bruises was indeed two overlapping adult human bitemark.*
***Method:** Bitemark analysis and comparison was done with the alleged biter, who was the boyfriend of the mother using Adobe Photoshop® overlay method.*
***Result:** The computer generated overlay using Adobe Photoshop® showed no inconsistent discrepancies between the alleged biter's teeth and the bitemark on the deceased toddler. The empty space within the bitemark injuries coincide well to the infra-occluded lower left central incisor of the suspect. The mandibular inter-canine distance of both bitemark injury and the suspect were also comparable. Therefore, it was concluded that the bitemark injuries on the deceased toddler was almost certainly done by the suspect.*
***Conclusion:** This case was brought to court in November 2011 and the forensic odontologist was called to testify on the bitemark evidence. The suspect was later convicted of the child abuse charges leading to death by the judge in March 2012 after considering the presence of bitemark injuries found on the body and also multiple bruises on the head. This case served as the turning point of bitemark evidence being admissible in the Malaysia court of law in which the evidence was handled by the a trained forensic odontologist right from the start when the deceased was first brought in by the police to the mortuary.*

***KEYWORDS*:** Forensic Odontology, Bitemark, Malaysia

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DIFFICULTIES ENCOUNTERED IN BITE MARK ANALYSIS

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The authors declare that they have no conflict of interest.

Unique personal features of jaws and teeth are analysed by forensic dentistry to provide help in identification practices. As an effective evidence, bite marks are important as much as blood stains, fingerprints and semen samples in the cases of unidentified sexual assaults and unidentified murders. Bite mark evidences have been widely used in the analysis of criminal cases for many years. In Turkey, first practices of bite mark analysis date back to 1993, and all bite mark evidences which are sent by prosecution offices are analysed by the Council of Forensic Medicine's (ATK) Morgue Specialization and Forensic Dentistry Departments. In the years between 2003-2013, 24 number of bite mark evidences were analysed, and 15 of these analyses resulted in positive identifications while the others failed because of a number of different reasons. The number of dentists is insufficient in Turkey. There is a need of legal reforms on this issue. ADOK association has conducted and plans further studies to make Forensic Dentistry more popular for the dentists in Turkey. Increasing the number of forensic dentists will provide help in crime scene investigations and further analyses. Plenty of factors affect to the results of bite mark analysis. Especially, imperfect photographing of bite marks cause great difficulties in the criminal analyses. Even tough, in some cases, deficient photographs are handled by some practical solutions, precautions have to be taken in order to prevent these kind of faulty photographings. Training dentists on forensic cases would make bite mark analyses and Forensic Dentistry applications more efficient, popular and effective.

***KEYWORDS*:** Forensic Odontology, Bitemark, Evidence

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USE OF THE ALLPROTECT TISSUE REAGENT® IN THE STABILIZATION OF DNA EXTRACTED FROM HUMAN DENTAL TISSUES AT DIFFERENT STORAGE CONDITIONS

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Background: The genetic-molecular methodology stands out as an accurate technique for human identification process and among the sources of biological evidence, the use of teeth is of great interest in Forensic Dentistry. Maintaining integrity of the material sent to laboratory is essential for success of the analysis, and one of the main difficulties is related to sample storage, which is usually carried out at low temperatures. This study evaluated the effectiveness of the Allprotect Tissue Reagent® (Qiagen, Germany) in stabilizing DNA extracted from human dental tissues stored under different conditions. Methods: In this study were used 160 teeth, distributed in two groups: intact teeth and isolated pulp tissue. The samples were stored with or without the product and varying the storage time and temperature. In addition to these groups, was formed a positive control group, composed by five teeth, which was stored at -20ºC for 180 days. After storage, DNA extraction, electrophoresis on agarose gel and genomic DNA quantification by Real-Time PCR were performed. The fragments of 32 samples representing every possible condition and five positive control group samples were analyzed to verify four pre-selected markers. Results: The agarose gel showed evidences of genomic DNA presence. Quantification results showed values ranging from 0.01 to 10,246.88 ng/µL of DNA. There was a decrease in DNA concentration in stored tooth samples at room temperature for 30 and 180 days compared to those stored for 1 and 7 days. Besides the time factor, temperature also influenced the DNA concentration, being higher in teeth that remained for 30 days and in tooth pulp maintained for 180 days, under refrigeration. Regarding the use of Allprotect Tissue Reagent® it showed a significant difference in stabilization of stored teeth at room temperature for 30 and 180 days. The analysis of fragments was possible in 37 selected samples, regardless of the DNA quantity variation, confirming that STR analysis using automated methods provides good results. Conclusion: The use of Allprotect Tissue Reagent® showed a significant difference in stabilizing DNA samples of intact human teeth stored at room temperature for 30 and 180 days, while in the other test conditions the results showed no justification for using this product.

***KEYWORDS*:** Forensic Odontology, DNA, Dental Tissues

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PROBLEMS IN HUMAN IDENTIFICATION VIA DENTAL RECORDS IN INDONESIA

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The authors declare that they have no conflict of interest.

Background: Recently, human identification become more popular. Legal matters such as deciding biological father for inheritance, identification of criminal victim or the suspect. Moreover, Disaster Victim Identification is important in flood, plane crash etc. Therefore, complete ante mortem dental record should be done in dental practice. In Indonesia which located in south east Asia which contains 18000 islands with 238 million people, despite a lot of mass disasters that often happened such as tsunami, human identification via dental records in Indonesians still become a major problem. Although government rules in Indonesia states that there is a penalty for not making complete dental record, the dentists' compliance still poor. Purpose: the purpose of this article is to reveal the problem which exist in human identification using ante mortem dental records in Indonesia and developing other tool for mass identification record. Review: Completing ante mortem dental records by following standardized requirement are important. In Indonesia, even though primary health care also have dental health personnel, completion of dental status often overlooked. Additionally, most people in Indonesia do not regularly come to dentist. Complete apical and panoramic radiographs are seldom done in daily practice, mostly because dental care in Indonesia are not covered by insurance. Nowadays, electronic identity card which become popularized in Indonesia could also included palatal rugae image. Palatal rugae is renowned as a valid bioindicator. Conclusion: The difficulty of human identification via dental records in Indonesia are not the dentists' awareness only; nevertheless also improper dental health system and the awareness of people to visit dentists regularly. The use of palatal rugae photograph is one of mass bioindicator of choice.

***KEYWORDS*:** Forensic Odontology, Identification, Dental records

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THE MEDICOLEGAL ASPECT OF ANTEMORTEM AND POSTMORTEM EYE EXAMINATION

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Forensic Medicine is fast growing and important branch of medicine. Some subdivisions of this subject like Thanatology, Toxicology are taking their shape separately. Forensic Ophthalmology is one of the newly emerging dimensions of the subject. A forensic pathologist can gather a lot of medico-legal information by examining the eye both in antemortem and postmortem cases. Various characteristics of the eye have also been thought to be useful in determination of PMI (postmortem interval). Specifically, authors have proposed measurement of vitreous humor analyses and intraocular pressure studies as a useful tool for this purpose. Through the years, a few papers have appeared which have suggested that the retina itself may be a telling means of determining PMI. Various biometric technologies have been considered for use within the military, including facial recognition, iris scanning, finger scanning, and voice verification. Iris scanning was deemed to be the most suitable current biometric technology. Ocular injuries are very common and are of great variety and complexity. Besides structural and functional loss they have social, occupational and medico-legal implications. Eye ball and its adnexa is a closely linked congregation of many delicate tissues which are affected in a variety of ways to various degrees.A large proportion of abused children have internal eye damage and clinicians are alert to the necessity of ophthalmoscopic examination to look for retinal hemorrhages, vitreous bleeding and displaced lenses. Aim of the work: To reveal the human eye as an important tool for many medico-legal investigations both in antemortem and postmortem cases. So I recommend that: Fundoscopic examination must be carried out after head trauma (in ICU). Fundoscopic examination must be carried out after all sudden deaths of children. Pars plana endoscopy is a conventional method in postmortem practices, which indicate the beginning of the non-interventional technique in the autopsy.

***KEYWORDS*:** Forensic Ophtalmology, Eye examination, Post mortem investigation

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CARBONIZED BODIES IDENTIFICATION – THE RESIN COMPOSITE FLUORESCENCE CONTRIBUTE

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***Background:** The identification of carbonized bodies is a challenge in the practice of Legal Medicine, especially due to the lack of information that is preserved after the action of high temperatures (1-4). In such cases, all the information that can be collected from the corps assumes vital importance (5-7). Teeth and dental materials, due to their high proportion of inorganic components have a special contribute in such cases. **Objectives:** The aim of this study is to evaluate the fluorescence of dental composites before and after they are subjected to high temperatures. It is also an objective to compare the fluorescence differences between three commercial brands of composites. **Method:** Three brands of dental composites Voco®, Kerr® and Colthéne® were selected with the commercial names of Grandio®, Herculite XRV® and Synergy D6® respectively. These materials have been subjected to a range of high temperatures (200ºC, 250ºC, 300ºC and 500ºC), during 1 hour. After that fluorescence was analyzed with a Fluorometer (Spex Fluorolog, FL 3-22) and assessed all the emission spectrum. **Results:** The dental composites analyzed showed differences in fluorescence spectrum at room temperature. At 200ºC, comparing the emission spectra with exciting λ of 400nm it is possible to distinguish the dental composites Herculite XRV® from Voco®. At 250ºC it is possible to distinguish, as well, from emission spectra the dental composite Herculite XRV® from Voco® and Synergy D6® (these last two materials have identical behavior). The fluorescence disappears, in all materials, at 300ºC. **Conclusion:** Every method of dental identification that is based in fluorescence of dental composites will be inconclusive, at temperatures of 300 or more Celsius degrees, but can differentiate, at lower temperatures, the brands of resin composite studied. In situations of victims subjected to high temperatures, when other methods of identification cannot be used, this method can provide additional and essential information to make the identification.*

***KEYWORDS*:** Forensic Odontology, Identification, Composite resin

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MACROSCOPIC CHANGES IN INCINERATED TEETH

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Subheading: Changes in the color and structure in incinerated teeth at different intervals of heat Background: Teeth are amongst the most resistant elements of the human skeleton and are thus often utilized in routine forensic investigation involving the identification of unknown remains. Teeth exposed to thermal stress have the potential to not only aid in identification, but also in understanding the circumstances surrounding the fire. This study aimed to relate structural and color changes that occur post heating to aid in proper handling of samples in a forensic scenario and to inform about incineration temperature based on tooth condition. Material and methods: A total of 70 teeth, extracted as a part of routine clinical treatment, were exposed to different temperature intervals, ranging from 100°C to 1200°C for 60 minutes using a laboratory oven. Unheated teeth were used as controls for the study. After incineration the teeth were photographed and radiographed to visually assess morphological changes. Results: Structural and color changes, and radiographic abnormalities were associated to the temperature interval at which the teeth were cremated. Conclusion: It was possible to inform about incineration temperature based on tooth condition when the color changes, photographic and radiographic images were utilized collectively.

***KEYWORDS*:** Forensic Odontology, Identification, Incinerated tooth

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INTERDISCIPLINARY APPROACH IN IDENTIFICATION OF HISTORIC REMAINS FROM EARLY BRONZE AGE CULTURE

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During the archaeological research of burial site from Bronze Age culture in eastern Poland, grave No. 10 was registered. The grave cavity was rectangular and oriented NW-SE. The skeleton of an adult male, lying on his back in a straight position, with the head oriented NW and accompanied by flint tools and arrowheads was recovered from the grave. The comprehensive examination of the skull and the few elements of postcranial skeleton was performed using the methods normally applied in forensic investigation. The methods used in the identification were as follows: 1. DNA analysis of samples from some bone fragments was performed. The results allow the establishment of the degree of kinship. For comparative analysis the samples from 12 other graves were collected. The analysis using STR and SNP markers can give more information about the ancestry of the remains. 2. Computer tomography and dental CT were used to obtain images for further investigation. CT scanning was performed with a GE Lightspeed CT scanner, using a protocol allowing isotropic voxel slices with 0,625mm thickness to be obtained. These slices were then used for secondary reconstruction (2D and 3D). GE Advantage Windows 4.4 workstation equipped with GE Healthcare firmware was used. All measurements were done with an accuracy of 0,1mm. Standard software for secondary reconstructions 2D MPR and 3D Volume Rendering was used. Dental CT was performed with the use of cone-beam tomography NewTom 3G (QR Verona, Italy). From axial images the pantomographic reconstruction of dentition was obtained and further used for dental age estimation.3. Estimation of the dental age- the method published by Kvaal et al. (1995). The method based on the radiographs was used because it requires neither extraction of teeth from alveolar sockets nor a section of the teeth. Both, excellent preservation of teeth and high quality of the image allowed for the appropriate measurements and resulted in the estimation of the dental age at the time of death.4. Reconstruction of geometry – the most important element of the data analysis in image processing is segmentation (extraction of anatomical structures from CT image). The quality of the 3D model of the skull depends on the correctness of segmentation process.5. 3D scanning of the skull using the optical scanner ATOS II (GOM).6. Facial approximation was performed based on anthropometric analysis of the skull and using the 3D skull reconstruction. Two different methods of facial approximation were used. The identification of human remains is complex and challenging for specialists and often requires the collaboration of experts representing many scientific fields. The

results of the investigation are of great importance for both, cognition (scope of human variability) and practice (in medico-legal proceedings). The results of the identification analysis which form the biological profile of the deceased in large extent depend on the reliability of applied methods. Moreover, the methods enable an approximation of the deceased appearance before the death. All the methods and modern techniques commonly used in forensic identification can be successfully applied in an analysis of the historical remains.Through the use of advanced methods the important information about the bony structures of the skull was obtained. The reconstruction of the skull was important for archivization. The approximation of facial appearance was also possible. Forensic experts added a small piece to historical puzzle.

***KEYWORDS*:** Forensic Odontology, Identification, Historic remains

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DENTAL PULP TISSUE – AN ENIGMA OF HIDDEN TRUTHS

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Predicting the time of death is an important aspect in forensic sciences. Various methods exist which help the forensic personnel in determining the post-mortem interval (PMI). However each of these methods, whether it is performed by some investigators at crime scene or determined by forensic pathologists at autopsy like rigor mortis, alger mortis, body lice, stomach contents etc., have their own limitations because of variable environmental conditions like humidity, temperature, insect activity, site of body etc. leading to difficulty in indicating the exact or near probable time of death of the individual. With the death of an individual all the tissues start to undergo degeneration and decomposition. The rate at which each tissue undergoes these changes differs, simply because of the nature or location of the tissue. Dental pulp is one such soft connective tissue which is safely enclosed within the dental hard tissues of all teeth. Thus, it is well protected and resists decomposition for a longer period even without formalin fixation. By studying the histological changes in the pulp at different times after death, it is possible to predict a probable time of death of an individual in varied environmental circumstances. Hence, this poster is an attempt to summarize our study on the histological findings in the dental pulp tissue at different times of death and thereby predicting the time of death of the individual.

***KEYWORDS*:** Forensic Odontology, Identification, Post mortem interval

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STEREOLITHOGRAPHY: A TECHNOLOGICAL AID IN CLINICAL AND FORENSIC DENTISTRY

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There has been tremendous progress on the technological innovations in the scientific world and the same holds true for the field of forensics. Three dimensional modeling by virtue of rapid prototyping is relatively a novel area of exploration in the forensics. Stereolithography is one such rapid prototyping technique which involves production of layer- by- layer fabrication of three dimensional physical models directly from computer aided designs (CAD). Stereolithography can find its effective use in both the clinical as well as forensic dentistry like the diagnosis and treatment planning for various complex maxillofacial and orthognathic surgeries, placement of surgical guides in oral implantology, three dimensional facial reconstructions, demonstration of facial injuries in medico legal cases etc. This poster aims at giving the brief introduction to this rapidly emerging technology and its possible applications in clinical and forensic dentistry.

***KEYWORDS*:** Forensic Odontology, Identification, Stereolithography

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SUPERIMPOSITION OF FRONTAL SINUS 3D VOLUMES

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Background:** In body identification exams the available antemortem data can determine the postmortem analysis. Recently, an increasing number of individual have few or no dental treatments, and unique anatomical features gain importance. In the literature, there have been reports of identification through comparison of the frontal sinus contour in Postero-anterior radiograph. The objective of this study is to develop and test a three-dimensional technique for frontal sinus comparative analysis. Method: Twenty Cone-Beam Computer Tomography (CBCT) exams (10 males, 10 Females) were selected of individuals between 20 and 40yo. A numerical list containing the names of the patients was created and then blindly randomized in the random.org website by two observers. Each one segmented and exported frontal sinus volumes in the open-source software InVesallius® and in MeshLab®, also open-source, the observers were able to superimpose the 3D models to connect the two randomized lists. A third observer received the individual results and assessed the level of correct matches. Results: Both observers reached an outstanding 100% accuracy. The software Meshlab was capable of superimposing the matching volumes while it placed models side by side if a negative comparison was detected, a characteristic that facilitated the analysis. Great deal of topographic unique features was noticeable in the volumes and, never the less, the compatibility was clear. Conclusion: The technique developed increases the usage of the Frontal Sinus identification method in new forms of three-dimensional exams such as CBCT, improving the results and the confiability of the forensic analysis.

***KEYWORDS*:** Forenisc Odontology, Identification, Frontal sinus

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THE FORENSIC ODONTOLOGY IN MILAN: A 20 YEAR EXPERIENCE

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Forensic odontology has a relevant importance in several fields of forensic sciences, from personal identification of corpse sand the living from video-surveillance systems, to the evaluation of lesions and odontoiatric damage and professional malpractice. In the last time forensic odontology has known a decisive improvement in the field of age estimation of the living for the ascertainment of imputability and age in adopted children, and from 2D images in cases of suspected juvenile pornographic material. The association with forensic odontologists has a relevant importance also in the assessment of bite marks and lesions in refugees seeking asylum. This poster aims at exposing some examples of the reliability of odontological techniques applied to the forensic scenario, chosen within the 20 year experience of LABANOF (Laboratorio di Antropologia e Odontologia Forense), which highlight the increasing requests from privates and the judicial authorities for expert witnesses concerning forensic odontology and the crucial role of university centers which may provide a reference point for assessing topics concerning this wide and crucial field of application of forensic sciences.

***KEYWORDS*:** Forensic Odontology, Forensic sciences, Milan

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MORPHOLOGIC PATTERNS OF LIP PRINTS IN A CROATIAN POPULATION: A PRELIMINARY ANALYSIS

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The authors declare that they have no conflict of interest.

Introduction: Cheiloscopy, a forensic investigation technique, deals with the study of elevations and depressions which form a characteristic pattern on the external surface of the lips. The positive identification of living or deceased persons using the unique traits and characteristics of the teeth and jaws forms a cornerstone of forensic science. Today, however, investigators may also rely on lip prints to identify possible suspects or to support evidence gained in specific investigations. Lip grooves are considered unique and analogous to the fingerprint. The aim of this research is to determine the pattern of lip prints and evaluate its uniqueness in a sample of Croatian population. Materials and methods: The study was conducted on randomly selected 37 male and 50 female subjects. Firstly, next to the centimeter blocks, lips were photographed with a digital camera Olympus µ-mini. After that, the lips were lubricated with a matte red lipstick, Catrice 080 My Red Card. Followed by taking lip prints on paper in a way that the subject slightly pursed its lips and pressed the paper with a light touch, first central, and then laterally. To preserve the sample it is covered with tape and digitally photographed. In this study, we followed the classification of patterns of the lines on the lips proposed by Tsuchihashi, which is the most widely used classification in literature. Results: Research has shown that most women in the Croatian belong to the type 2 (40%), it follows type 1 (34%). Type 3 (12%), 4 (8%) and 5 (6%) are of less importance. Most of the male belong to type 3 (38%) and type 2 (22%) and a small number of types of 4 (16%) 5 (13%) and 1 (11%). Conclusion: This results give an insight in the patterns of lip prints in a Croatian population supporting the hypothesis that lip prints are capable to distinguish individuals and may be useful in sex determination.

***KEYWORDS*:** Forensic Odontology, Identification, Lip print

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A PILOT STUDY ON MATURATION OF CERVICAL VERTEBRAE AND PERMANENT TEETH

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The authors declare that they have no conflict of interest.

Teeth are frequently used to estimate age in forensic science but few reference data exist of cervical vertabrae stages for age. Maturation of the cervical vertebrae, seen from cephalometric radiographs are used by orthodontists to predict the pubertal growth spurt to target the timing of treatment. The relationship between cervical vertebrae and dental maturation is not well understood. The aim of this pilot study was to assess maturation of the cervical vertebrae (CVM) in terms of dental maturity and age and explore if CVM might be applied to estimating age. The sample was archived lateral cephalograms and panoramic dental radiographs of 30 boys and 30 girls (aged 8.60 to 19.31 year) taken on the same day. Cervical vertebrae maturation (using Hassal and Farman, 1995) and dental maturity (using Demirjian, Goldstein and Tanner, 1973) was assessed by the first author. Intra-observer reliability of bone staging and tooth stage was calculated using Kappa. The mean age of each cervical maturation stage (CVM) was compared between boys and girls using a t-test. Kappa was 0.65 for bone (60 bone stages) and 0.85 for teeth (420 tooth stages).Mean ages for each cervical maturation stage were not significantly different between boys and girls but was earlier in girls compared to boys. All individuals in CVM stage IV were aged between 10.3 and 13.7 years. All individuals in CVM stage V were older than 11.9 years. Stage III was most variable for both dental and chronological age. These results suggest that CVM might be applicable to estimate age.

***KEYWORDS*:** Forensic Odontology, Age estimation, Cervical vertebrae

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DISCRIMINANT ANALYSES TECHNIQUES: APPLICATION ON SEXUAL DIMORPHISM

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The authors declare that they have no conflict of interest.

In a forensic sciences context, it's necessary to differentiate males from females, and there are several techniques in this regard. One factor that has the potential to improve the techniques efficiency is the statistical analysis performed. The objective of the study is to verify if one of four types of discriminant analysis has higher capacity of differentiate sex in comparison with the others. Sixty-three skulls were used, and the frontal angle measurement was performed. They were taken using a skull stabilizer (IMECRAN). The discriminant analyses were: linear, logistic, quadratic (QDA) and kth-nearest-neighbor (KNN). Stata 12.0 program was used. In the linear analyses, it was observed 66.67% of female matches and 60.61% of male ones. Using logistic discriminant analysis, it was observed 63.33% of female matches and 66.67% of male matches. The QDA showed, respectively, 76.67% and 51.52% of female and male matches; finally, KNN presented better results: 100.00% and 96.97% of coincidences among females and males, respectively. In conclusion, KNN improves the technique precision of using the frontal angle in order to perform sex determination.

***KEYWORDS*:** Forensic Odontology, Identification, Sex determination

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HUMAN DENTAL AGE ESTIMATION BY CONE BEAM COMPUTED TOMOGRAPHY - AN IN VITRO STUDY

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Background: *The formation of secondary dentine leads to an age-related decrease of the dental pulp cavity volume. Hence, the volume of the pulp cavity relative to the volume of its tooth could be useful for dental age estimation. This study aimed to evaluate a method for dental age estimation based on three-dimensional cone-beam computed tomography (CBCT) x-ray images of extracted teeth by using the diagnosis and therapy planning software VoXim (IVS Technology GmbH, Chemnitz, Germany).* ***Methods:*** *A sample of 69 single-rooted teeth from 26 patients aged 19-89 years was collected for this pilot study. The teeth had no caries or signs of restaurative dental treatment and showed unimpaired root apices. All teeth were scanned by a cone-beam CT (Accuitomo, J. Morita, Kyoto, Japan) using an clearly defined experimental set up ensuring a uniform exposure setting that had been determined by pretrials. Using threshold segmentation, three different methods for segmentation and volume measurement of enamel, dentine and pulp cavity were tested: Besides a reproducible method using the aid of software default settings, two manual techniques were developed. As one of the manual techniques used strictly defined procedures, it also allowed reproducibility. In order to evaluate the accuracy of a non-reconstructable, manual method, its intraobserver error was determined by repeated measurements. Tooth and pulp volumes and volume ratios were calculated for the whole tooth (pulp cavity to the whole tooth, W; pulp cavity to the whole tooth excluding enamel, WE), for the root region (pulp cavity to the root region, R) and at four levels (crown area, coronal third, midroot, apical third) using segmentation by the default settings. The relationship between the volume ratios and age was determined by Pearson's correlation coefficient (r), the accuracy of age estimation by the determination coefficient* R^2*. The Wilcoxon sign rank test was employed to measure the intraobserver error of manual segmentation.* ***Results:*** *From the three segmentation methods, the manual non-reconstructable method showed the highest correlation and coefficient of determination* (R^2 *= 0,663). There were no statistically significant intra-observer differences between the volume ratios calculated from repeated measurements. From the specific volume ratios, the pulp/tooth ratio for the whole tooth when enamel was excluded (WE) showed the highest accuracy for age estimation* (R^2 *= 0,585). From the volume ratios of tooth segments, the highest correlation was observed for the coronal third of the root* (R^2 *= 0,621).* ***Conclusion:*** *The results confirm those of other authors obtained by micro-CT. To our knowledge this is the first study on the accuracy of CBCT three-dimensional x-rays for dental age estimation obtained in a clearly defined in-vitro experimental*

design using special planning software. The results provide support for the use of tooth-pulp volume measurements from clinically acquired CBCT images for age estimation.

***KEYWORDS*:** Forensic Odontology, Age estimation, CBCT

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COMPARISION OF DENTAL AND CERVICAL ESTIMATES OF CHRONOLOGICAL AGE IN CHILDREN WITH VARIOUS SAGITTAL SKELETAL MALOCCLUSIONS

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The authors declare that they have no conflict of interest.

Background:** The purpose of this study was to estimate the chronological age of children with various skeletal sagittal malocclusions, using dental and cervical age estimation methods, and to investigate if in skeletal Class I , II and III, dental and cervical age assessment methods produce comparable estimates of chronological age. **Methods:** The sample consisted of panoramic dental images and lateral cephalograms of 231 orthodontic patients (127 girls and 104 boys) aged 5.9 to 15.8 years, collected at the Department for Orthodontics, School of Dental Medicine, University of Sarajevo. Dental maturation was evaluated according to Willems and Demirjian methods, while sagittal skeletal malocclusions were evaluated using ANB angle from lateral cephalograms. The skeletal age was evaluated using Baccetti's cervical maturation method. The pre-pubertal (Cervical Stage 1 and Cervical Stage 2), pubertal (Cervical Stage 3 and Cervical Stage 4) and post-pubertal (Cervical Stage 5) growth phases were calculated for girls and boys separately. MANOVA was used to evaluate the relationship between skeletal malocclusions and dental and cervical age estimates. **Results:** Dental age methods overestimated chronological age. The Demirjian method overestimated the age of girls by 1.24±1.03 years, and age of boys by 0.80±1.03 years. The Willems method overestimated the age of girls by 0.36±0.98 years, and that of boys by 0.44±0.98 years. No differences were found in estimates of chronological age using skeletal pattern methods. **Conclusions:** There is no difference between dental and cervical maturation among sagittal skeletal growth patterns. While both dental age methods overestimated chronological age of sampled children, the Willems method yielded smaller estimation errors and is therefore suggested to be more appropriate for chronological age estimation than the Demirjian method.

***KEYWORDS*:** Forensic Odontology, Age estimation, Skeletal malocclusion

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ROLE OF FORENSIC DENTISTS AT DVI CASES IN TURKEY

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The authors declare that they have no conflict of interest.

Forensic odontology has three major areas of utilization: diagnostic and therapeutic examination and evaluation of injuries to jaws, teeth, and oral soft tissues; the identification of individuals particularly in mass disasters; bite mark analysis particularly in assault cases. Identification process of human remains is a process with difficulties. Developments in techniques and technological advances for identification process resulted in an increase in success rate, but there still exists insufficiencies. Dental records are important especially in identification of mass fatality victims and age determinations. Forensic dentists play an important role on the Identification in mass disasters. Identification from dental records can be carried out quickly and inexpensively. Forensic dentists should take an active role in DVI teams. Unfortunately, there are not enough forensic dentists in Turkey. Training programs on forensic odontology should be popularised and enlarged. DVI teams must have a good education & training, and have the opportunity to move immediately to the scene. Standardized forms and appliances must be used. For dental medicine, a Standard approach must be established for dental records. By on –line information network, access to all dental records must be facilitated. All the information about the health status and radiographs must be stored in a digital environment. Due to the increase in the number of traveling people, the possibility of remains belonging to a person reported to be missing from a point far away is increased.. At national level, a database system for all missing people must be established, and linkage with identification centers must be formed. In recent five dvi cases in Turkey, forensic dentistry was practiced. However, there were organizational issues due to the inefficiency of forensic dentistry field in the country and the lacking number of bite mark records. Training an enough number of dvi units would prevent further problems which may occur in future mass fatalities and provide better results in criminal cases.

***KEYWORDS*:** Forensic Odontology, Disaster victim identification, Turkey

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A STUDY ON THE RELIABILITY OF GENDER AND STATURE ESTIMATION FROM HEAD CIRCUMFERENCE, INNER CANTHAL DISTANCE, INTER CANINE & INTER-ALAR WIDTH IN NORTH INDIAN POPULATIONS

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The authors declare that they have no conflict of interest.

Background: Biological identity of an individual can be determined by its sex, age, stature, and ancestry background. This becomes important in many of the medico legal cases where identity of the deceased has to be established. Out of the four biological indicators of identity, assessment of sex particularly has significant contribution in construction of a physical profile of the decedent. While forensic and archaeological excavations, skull and teeth often provide the only identification material and the methods of gender determination depend on their condition. Craniofacial anthropometry is a vital tool in making a precise and systematic measurement of human skull, so as to deduce sex of dead individuals. Among the various craniometrical dimensions, the most important ones are height and width of head. Laeeque et al in 2013 observed an important role of head circumference and biparietal diameter of skull for determination of gender. George and Bhat in 2010 have successfully shown in their data gender differentiation by means of inner canthal width. Patel et al in 2011 have highlighted the significance of inter-alar width in sex differentiation while studying the relationship between intercanine width, inner canthal distance, and inter alar width. Teeth are very important elements in the identification of skeletal remains, especially in cases when, due to the poor preservation of skeletal remains, the identification is not possible by standard methods. Sex determination using dental features is primarily based on the comparison of tooth dimensions in males and females. Canines vary from other teeth with respect to survival and sex dichotomy. In forensic identification of unknown human remains, stature estimation is also a preliminary important step. In a study by Karthikeya et al; significant correlation has been shown of diameter and circumference of skull and combined mesiodistal width of maxillary anterior teeth with stature or height of an individual by means of regression analysis. Studies have been done on sex differentiation using craniometrical and odontometrical data in different parts of India, however the literature is scanty for the north Indian population especially in Uttar Pradesh. This fact has inspired us to carry out a study in Uttar Pradesh population, aiming to estimate sex and stature based on combined mesiodistal width of maxillary anterior teeth, right and left maxillary canine width, head circumference, inner canthal distance, inter alar width, and skull diameter. Methods: Cross-sectional

A Study On The Reliability Of Gender And Stature Estimation From Head Circumference, Inner Canthal Distance, Inter Canine & Inter-Alar Width In North Indian Populations. *Shalini Gupta*

prospective study was conducted involving 100 participants. Craniometrical and odontometrical measurements were obtained with the help of Vernier Caliper with resolution of 0.02 mm and a non stretchable measuring tape, following the methods used by Kalia et al, Dhara et al, and Patel et al. Gender and height was regressed against each measurement so as to derive linear regression equations based on combined mesiodistal width of maxillary anterior teeth, right and left maxillary canine width, head circumference, inner canthal distance, inter alar width, and skull diameter. Data was also studied as ratio of different measurements. Finally discriminant function analysis was done for height. Results: All recorded craniometrical and odontometrical measurements were significantly different between males and females. Ratio of measurements was also significant among males and females except for head circumference to combined mesiodistal distance of maxillary anterior teeth and height to skull diameter. Head circumference significantly predicted the height of male and female, while a poor correlation was observed between height and other parameters among male and females. Conclusions: Craniometrical and odontometrical measurements recorded can successfully be used for gender determination but not for stature.

***KEYWORDS*:** Forensic Odontology, Identification, Craniometry

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FORENSIC ENDODONTOLOGY

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The authors declare that they have no conflict of interest.

Forensic odontology has been defined as that branch of dentistry which, in the interest of justice, deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of dental findings. Forensic odontology has played a key role in identification of persons in mass disasters (aviation, earthquakes, Tsunamis), in crime investigation, in ethnic studies, and in identification of decomposed and disfigured bodies like that of drowned persons, fire victims, and victims of motor vehicle accidents. The various methods employed in forensic odontology include rugoscopy, cheiloscopy, bite marks, tooth prints, radiographs, photographic study, and molecular methods. Though the shortcomings with these various methods are few, the discrepancies associated with them are to be weighed cautiously to make forensic odontology a more accurate, reliable, and reproducible investigatory science. Dentistry has much to offer law enforcement in the detection and solution of crime or in civil proceedings. Forensic dental fieldwork requires an interdisciplinary knowledge of dental science. Most often the role of the forensic odontologist is to establish a person's identity. Teeth, with their physiologic variations, pathosis and effects of therapy, record information that remains throughout life and beyond. Forensic odontology has an important role in the recognition of abuse among persons of all ages. Dental professionals have a major role to play in keeping accurate dental records and providing all necessary information so that legal authorities may recognize malpractice, negligence, fraud or abuse, and identify unknown humans. Forensic odontology involves the management, examination, evaluation and presentation of dental evidence in criminal or civil proceedings, all in the interest of justice. The forensic odontologist assists legal authorities by examining dental evidence in different situations. The subject can be divided roughly into 3 major fields of activity: civil or non-criminal, criminal and research.

***KEYWORDS*:** Forensic Odontology, Identification, Dental evidence

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INFANT ORAL MUTILATION (IOM)

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Objective: The removal of primary canine tooth buds is a harmful oral mutilation. It is performed in infants/babies aged 12 months and below, in many countries of eastern Sub-Saharan Africa and is justified by a therapeutic reason. This library-based research shows the epidemiology of IOM, the believed therapeutic meaning, the management of the practice and the risks and consequences for the children, in the short and in the long term. Design: A review of the literature from 1960s, on infant oral mutilation in Africa and his diffusion in the world. Methods: Journal articles on search engines like PubMed, Scopus, Dentaid Organization, Google and their bibliography. Results: Infant oral mutilation is a practice performed by a variety of village healers and it is a custom that passes between communities and tribes. IOM causes severe pain, serious oral health complications and, often times, death. The beliefs and attitude of parents and relatives about teething have serious implications for management of childhood fevers which may deserve urgent medical treatment. Long term effects of IOM can include malformations of primary and permanent teeth, missing teeth, facial disfigurement and transmission of blood borne disease such as HIV/AIDS. Failure of parents to disregard these attitudes and beliefs is indeed worrisome as serious childhood illness, which are unrelated to teething, are likely to be left untreated or may not be given the seriousness they deserve. Conclusions: Protecting children against the practice of IOM is everyone's responsibility. This kind of violence against infants is not justifiable or acceptable at all. International human rights laws are based on respect for every person's human dignity. Infants, as people, should receive no less protection than adults. There have been several reports of IOM being seen in immigrants from many countries of eastern sub-Saharan Africa to France, Israel, Norway, Sweden, Uk, USA, Australia and New Zealand. Dental professionals who practice in developed Countries must be aware of possible occurrence of IOM consequences in their patients.

***KEYWORDS*:** Forensic Odontology, Child abuse, Dental mutilation

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REMOVAL OF A MIGRATED DENTAL IMPLANT FROM THE MAXILLARY SINUS AFTER 7 YEARS: CLINICAL MANAGEMENT AND MEDICOLEGAL CONSIDERATIONS

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The accidental displacement of dental implants into the maxillary sinus is an infrequent but possible complication in dental clinical practice. The main cause of implant displacement is the inadequate bone height in the posterior maxilla. This event usually occurs during surgery, while rarely reported in the post-operative period, especially with long-term follow-ups. The aim of this study is to present an unusual clinical case of implant migration at the time of abutment connection inside the maxillary sinus, the removal 7 years later and the discussion of medico-legal aspects.

***KEYWORDS*:** Forensic Odontology, Dental malpractice, Dental implant

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CHILD PROTECTION: LEGAL AND ETHICAL OBLIGATIONS IN REPORTING CHILD ABUSE

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Background: Child protection is a duty of every single member of the society. Health professionals who work with children, such as members of dental team, are in the unique position to recognize signs of physical, sexual and emotional abuse as well as (dental) neglect. They should report any suspected case where a child is or may be in need of welfare. The professional responsibility is regulated by legal and ethical obligations. Legislation covering child protection can be divided into two main categories: civil law and criminal law. Method: In this preliminary work the authors investigate the legal and ethical acts, and the similarities vs. differences in obligations regarding reporting child abuse and neglect (CAN) cases in four countries: Croatia, United Kingdom, Italy and Canada. Results: In all four countries all medical professionals (and officials) have a duty to report their suspicion if a child is in an harmful situation, thus requiring the need of protection and assistance. Additionally, people working closely with children should raise their awareness on possible signs of CAN, and report any suspicious or uncommon behavioral signs. All professionals or officials who fail to report, or even neglect or delay to report a suspicion, are liable on conviction to a pecuniary fine which varies from country to country. Depending on the country, if a professional has reasonable grounds to suspect that a child is or may be in need of protection, must report to: CAS (children's aid society), to CSS (center for social services), to police, to Juvenile Court, or to the ombudsman. The report should be made, immediately or up to 48 hours from the moment of suspicion. In all four countries, dentists are not asked to diagnose 'child maltreatment', but simply report the suspicion with supportive evidence. Ethical obligation comes from medical and dental ethical codes, which is in all four countries regulated by the Chamber or Council of Dentists. In general, ethical obligations cover protection of children, the elderly and the disabled, in particular when the environment, family or the community in which they live is not sufficiently responsive to health care. Conclusion: All four countries consider children as a vulnerable group which should be protected. Legal and ethical obligations in reporting CAN are similar. Differences are related mostly to fines for non-reporting or a delay in reporting to judicial authorities. Expanded investigation through other European countries and standard operational procedures is needed, in order to harmonize policies and guidelines for reporting CAN and maximize children protection.

***KEYWORDS*:** Forensic Odontology, Ethics, Child abuse

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UNDER THE LENS: DENTAL EXPERT WITNESSES IN BRAZIL, CROATIA, UK, SAUDI ARABIA, INDONESIA AND ITALY

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Dentists treat and try to heal oral disease thereby improving oral health and masticatory functions. Dental professionals can also be involved in medico legal and forensic activities related to Expert Witness (EW) testimonies translating damage to teeth, jaws and temporo-mandibular joint for malpractice cases, car accidents and work related or non accidental injuries. When called to act as expert witness by the Court, the appointed dentist has to combine biological and technical knowledge with medico-legal and forensic knowledge. Pecuniary and non-pecuniary damages evaluation requires specific training in medico-legal matters, legal procedures and forensic criteria. Nevertheless, there are significant differences in the world regarding dental damage evaluation criteria as well as huge differences in the requirements to become eligible as Expert Witness in Court. A dental Expert Witness, working privately or working for the Court, has precise responsibilities and is subject to civil or criminal proceedings (depending on the judicial system) if found wanting. In forensic and legal dentistry a medico-legal doctor should not work in isolation from a dentist if the case involves dentistry. On the other hand it is not wise for a dentist to work in forensic and legal cases without a specific training in judicial disciplines and law. In this work the authors investigate the common and civil law judicial systems regarding the appointment of expert witnesses in Brazil, Croatia, UK, Saudi Arabia, Indonesia and Italy and expanding to investigate legislation in other European countries, to work towards harmonization and reach the best criteria to become eligible as an Expert Witness in Court. Further steps for quality assurance in legal dentistry and forensic odontology training should be considered to prevent spontaneous involvement of dentists and improve their forensic and law background.

***KEYWORDS*:** Forensic Odontology, Accreditation, Dental expert

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DENTAL RITUAL MUTILATIONS

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Objective: Dental ritual mutilations have occurred throughout history in human populations around the world. This library-based research shows the epidemiology and the type of dental mutilations, the meanings, the risks and techniques involved, and their consequences. Design: A review of the literature from early 1960s, on dental ritual mutilation in the world. Methods: Journal articles on search engines like PubMed, Scopus, Google and their bibliography. Results: Dental mutilations are performed today in rural community or indigenous tribes in several areas of the world, most notably in Africa, Asia, Oceania. The intentional dental ritual modification or mutilation can be done for many reasons such as aesthetic, tribal identification, sexual purposes and curious others. Their consequences are often underestimated, especially if there is a change in the cultural environment due to immigration. Conclusions: The ideas about teeth are culturally determined. Intentional dental mutilation is a practice that can be seen in virtually all societies throughout history. Dental mutilations, for the people that follow these practices, may be viewed as a source of pride or as a mean to help the identifying with the group to which they belong or as attractive of the opposite sex. By looking at both the cultural conformity and the costly signaling theory, it becomes evident why dental mutilation has occurred for such a vast amount of time and will continue to occur. The presence of dental ritual mutilations can be important, for the forensic dentist, in order to identify the ethnic origins and the cultural background of living or dead persons or even human remains.

***KEYWORDS*:** Forensic Odontology, Identification, Dental mutilation

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DENTISTRY IN HUMANITARIAN AID MISSIONS: ETHICAL AND MEDICAL- LEGAL ASPECTS

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Humanitarian aid is a sort of solidarity generally intended for third world countries and victims of war or natural disasters, and whose main objectives are to save lives and to alleviate suffering, along with respecting human dignity and improving the quality of life of people with no health care services. The phenomenon has undergone significant growth in recent decades and now finds itself in a situation, where humanitarian aid professionals, including dentists, need to take steps ahead to understand the challenges to face. The authors have examined the issue of dentistry in humanitarian aid missions, firstly indicating their objectives, which are:1. Reduction of oral pathology.2. Promotion of training of local staff.3. Construction of new health centers, or reorganization of the existing ones, for prevention purposes and professional therapy.4. Promotion of oral hygiene educational programs in schools.5. Documentation and promotion of the culture of cooperation and/or volunteering. Implementation problems are highlighted, related not only to the scarcity of economic resources available and the absence of a "tradition" of disease prevention in many developing world countries, but also to the obstacles of a cultural, linguistic, access to care, religious practices and rituals. Dentists must in fact try to do their best in the reality in which they find themselves, taking into account the peculiarities of the different cultures, whilst pursuing the real interests of the patient. The issue of consent, for example, often presents in quite a different way than we are used to in the West: sometimes there is no experience of "paper" contracts, sometimes it is the village chief or the family head who takes the decisions for the members of his community / family. It is often the father or a male member of the family who makes decisions relating to females' health. Decisions relating to the choice of treatment can also be complex; it is not uncommon, in fact, that a dentist is called to treat patients who have undergone long, tiring, difficult and sometimes dangerous journeys, often on foot, to reach the first place where it is possible to undergo treatment; choosing therapies which must be completed quickly (to allow the subjects to return to their villages as soon as possible), rather than other kind of better and/or more suitable treatments. The reduced availability of materials and techniques limits greatly the range of options which can be offered by the professional, who often must perform treatments other than the ideal ones. The need for triage and choice, due to the reduced availability of resources, and the consequent need for the assessment of each individual situation, can lead to therapeutic decisions which would be considered unacceptable in different situations.The authors analyze ethical and medical-legal issues, based on the activity of dentists in humanitarian aid missions, particularly with regard to informed consent, the choice of treatment and clinical trials. In

relation to these issues, there are, at an international level, a number of documents which state the fundamental ethical principles which should guide the practitioner's practice, keeping firmly in mind the needs of the developing countries, the vulnerable indigenous communities and populations. However in daily practice it is not always possible to operate in accordance with these indications.

***KEYWORDS*:** Forensic Odontology, Ethics, Humanitarian aid mission

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ETHICAL AND LEGAL ISSUES OF HIV TESTING IN THE DENTAL SETTING

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Background: The emergence of the HIV/AIDS pandemic has challenged traditional ethical values of the health care profession. These include the infectious nature of HIV, the social stigma of the disease and its ethical and legal dilemmas. This poster presentation will address some of the pertinent questions related to HIV infection and AIDS. This presentation is structured around the following: autonomy and consent, confidentiality, disclosure, knowledge of patient and provider HIV status, the right to choose whom to treat, testing for HIV, and the importance of HIV policies in the workplace to guard against discrimination. The three broad principles of ethics, namely, autonomy, beneficence and justice, provide the basic framework on which this poster presentation is based. Biotechnology advances in the rapid oral fluid diagnostic testing particularly in the detection of HIV antibodies from patients in the dental setting have raised additional ethical and legal considerations for both research and clinical treatment and in the subsequent management of HIV infected patients to include disclosure of test results to the patient and proper referral to physicians or nurse practitioners. Dentists saw a major shift in their role as oral diagnosticians testing for HIV antibodies. That shift also necessitated an in-depth understanding of bioethical principles and their judicious application in clinical management. The oral health care worker must thus have a solid foundation in the application of bioethical principles. The principles of biomedical ethics from medical practice have now become even more important and need to be integrated into dental practice. Lack of understanding and the wrongful application of ethical principles may lead to patient harm and legal liability. Conclusion: The multifaceted challenge of the HIV/AIDS pandemic has had a profound effect in dental practice necessitating a re-examination and application of the concepts of ethics, responsibility, autonomy and justice. On a global scale it has raised moral concerns of social justice with regard to access to health care, basic human rights, the government's responsibility to care for its citizens, and the duty of beneficence of the developed towards the developing world. On a national level it has re-opened debates on issues of distributive justice and fairness. The understanding of bioethical principles and their judicious application should ensure that patients with HIV infection are justly treated commensurate with any patient who suffers from a chronic illness. Given the increasing numbers of people living with HIV worldwide, polices must be upheld and revised as needed to protect healthcare providers, patients, and society generally against stigma and discrimination.

***KEYWORDS*:** Forensic Odontology, Ethics, HIV test

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