A Review

Dental Detectives: Unveiling the Forensic Symphony of Prosthodontics and Odontology in Swift Victim Identification

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Abstract

Background:

Forensic odontology, a discipline with historical roots dating back to 66 AD, plays a crucial role in identifying victims within the legal system.

The term "forensic" is derived from the Latin word 'forum,' meaning a court of law, while "odontology" refers to the study of teeth. This specialized field of dentistry contributes to justice by carefully examining dental evidence and presenting essential findings.

Dental records and the expertise of forensic dental surgeons are particularly important in identifying deceased individuals, especially in cases where visual or fingerprint methods are insufficient due to postmortem changes or injuries. Prosthodontists, specialists in dental prosthetics, are becoming increasingly indispensable in maintaining comprehensive records.

In situations where fingerprinting is impractical, dental identification becomes a critical tool. Forensic odontology focuses on scrutinizing dental evidence for legal purposes, highlighting the uniqueness of teeth influenced by various factors. Individually tailored dental prosthetics serve as primary identifiers in forensic cases involving unidentified bodies, filling crucial gaps where fingerprint databases fall short.

During major disasters like aviation accidents or natural calamities such as earthquakes, swift and accurate victim identification is imperative. Victims with intact or most of their teeth provide vital characteristics for effective forensic identification. Prosthodontists, equipped with diverse identification techniques, play a pivotal role in such investigations, particularly when victims have dental prosthetics, offering essential clues for identification.

Comparing postmortem dental remains with pre-death records, such as X-rays, is a common practice to confirm identities. Denture markings play a significant role in this process, providing a swift and reliable method of identification, especially when other methods fail.

While standardized methods may be lacking, dental practitioners are urged to maintain comprehensive records, including denture markings, emphasizing the importance of readiness for disaster identification. Materials like all-acrylic dentures can be inscribed with a patient's name before fitting, contributing to rapid identification.

Notably, in severe accidents where limbs are damaged, certain denture materials, particularly acrylic and metal-based types, often survive, enabling quick identification during calamities. Forensic odontology, an integral part of forensic science, has utilized dental findings for a century to aid the legal system.

Beyond traditional methods, salivary samples from prosthetics have emerged as valuable DNA sources for identification, adding an additional layer to the multifaceted role of dental evidence in forensic investigations.

This narrative review article underscores the crucial role of a prosthodontist in identifying deceased

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individuals when appropriately trained. It emphasizes the interplay between prosthodontics and forensic medicine, detailing how prosthodontists can employ various techniques for identification. Specifically, the article delves into denture identification methods, emphasizes the benefits of denture labeling for swift identification during major incidents, and underscores the importance of maintaining comprehensive patient records. It also highlights the synergy between Prosthodontics and Forensic Odontology, showcasing their combined potential to streamline forensic investigations.

Keywords: Antemortem records, Bite marks, Dental, Dental implant, Denture, Denture identification, Denture in disaster, Denture in investigation, Denture labelling, Denture marking, Denture naming, DNA matching, Engraving, Forensic dentistry, Forensic medicine, Forensic odontology, Inclusion methods, Interdisciplinary approach, Lip prints, Marking/labelling, Palatal rugoscopy, Postmortem dental profile, Primary identifier, Prosthetic appliances, Prosthodontics.

Introduction

Forensic odontology, a subdivision of forensic science focused on dental evidence within legal contexts, traces its origins back to 1897 with the pioneering work of Dr. Oscar Amoedo.[1] Its significance lies in human identification, particularly in challenging scenarios like mass disasters and aviation incidents. Dental structures, known for their durability, often persist longer postmortem compared to other tissues. Harvey and Keiser-Nielson defined forensic dentistry as the handling and examination of dental evidence for the purpose of justice,[2] underscoring its critical role in mass disasters and intricate identification situations. Forensic dentistry encompasses a range of identification aspects, including the use of dental records for comparative identification.

In cases where antemortem data is lacking, forensic dental surgeons become pivotal in the search for individuals. Moreover, forensic dentistry proves invaluable in mass disaster scenarios, leveraging dental evidence to provide crucial insights and contribute to resolving complex forensic cases. Prosthodontists emerge as key contributors to forensic dentistry, particularly when natural dentition is absent. Their involvement extends to patient identification through the analysis of dental features like restorations, prostheses, and bite marks. The durability of dental structures, coupled with advancements such as laser etching and RFID tags, enhances the precision of forensic identifications.[3] Throughout history, dental records, including radiographs, have played a significant role in high-profile identifications, such as those of Adolf Hitler and Saddam Hussein.[4] The continuous evolution of technology further refines the collaboration between forensic odontologists and prosthodontists, augmenting their capabilities in identification.

In conclusion, forensic odontology, supported by technological progress and interdisciplinary collaboration, remains a crucial component in justice systems worldwide.

The history of forensic dentistry is replete with instances highlighting the pivotal role of dental evidence in identification:

1. **US Revolutionary War (1775):** Paul Revere, a young dental surgeon, utilized the bridgework of war casualties for identification.[5]
2. **Countess of Salisbury (1835):** A gold denture played a crucial role in identifying her charred remains.[6]
3. **Dr. George Parkman (1849):** Despite a complete burn, a tooth fragment fused to gold in his removable partial denture facilitated his identification.[7]
4. **World War II:** Among 819 unidentified soldiers, only nine were recognized through their dentures due to the lack of proper antemortem record practices.[8]
5. **Modern Disasters and Events:** Dental evidence has been vital in identifying victims of various events, including the World Trade Center attack in 2001 and the tsunami affecting European tourists.[9]
6. **Historical Notable Cases:** In 66 AD, Agrippina identified a victim using a discolored front tooth,[10] and in 1191, M. Raja JayachandraRathore's artificial teeth post-battle in India marked an early instance of dental identification.[11]
7. **Leaders and High-profile Individuals:** The identification of Adolf Hitler after World War II heavily relied on dental records, radiographs, and prostheses, while Saddam Hussein's capture was verified using DNA from saliva samples.[12]

These examples underscore the enduring significance of dental evidence in forensic contexts throughout history. Table 1 summarizes the evolution of forensic dentistry.

S.No.	Event	Year	Significance
1.	US Revolutionary War	1775	Paul Revere used bridgework for identification of casualties
2.	Countess of Salisbury	1835	Gold denture identification charred remains
3.	Dr. George Parkman	1849	Tooth fragment in gold denture aided post-burn identification
4.	World War II	-	Only 9 out of 819 soldiers recognized via denture
5.	Modern Disasters and Events	Various	Dental evidence in identifying victims (e.g., 9/11)
6.	Historical Notable Cases	66 AD	Agrippina identified victim with a discolored front tooth
7.	Historical Notable Cases	1191	M. Raja Jayachandra Rathore's artificial teeth in India
8.	Leaders and High-profile individuals	World War II	Adolf hitler identified through dental records and radiographs
9.	Leaders and High-profile Individuals	-	Saddam Hussein's capture verified using DNA from saliva

Table 1 – History of Forensic Dentistry

Significant Points on Dental Identification in Forensics, with a Focus on Denture Marking:

1. **Comparative Dental Identification:** Postmortem dental remains are compared with antemortem dental records for identity confirmation, relying on meticulous record-keeping by dental professionals.[13]
2. **Intelligent Dental Identification System (IDIS):** Utilizes structured data analysis to integrate essential dental data for identification purposes.[14]
3. **Disaster Victim Identification Process:** Involves body tagging, fingerprinting, forensic pathology, and dental examination, with prosthodontists contributing significantly to the dental aspect of identification.[15]
4. **DNA Identification:** Teeth serve as an excellent source of DNA due to their resilience against environmental factors. DNA analysis, a complex and costly method, is employed when other identification methods are inconclusive.[16]
5. **Photographic Superimposition:** Challenges but effectively matches a denture to skeletal remains, especially when combined with other methods.[17]
6. **Palatal Rugae in Identification:** Unique palatal rugae patterns are used for identification, particularly in cases where fingerprints are unavailable.[18]
7. **Denture Labeling:** Crucial for victim identification, especially in disasters. Various methods, from surface marking to electronic microchips, exist. Lack of labeling can impede identification processes.[19]
8. **Methods of Identification:** Primary methods include dental features, palatal rugoscopy, and DNA analysis. Antemortem records, particularly detailing dental work, aid in identification.[20]
9. **Advantages of Denture Labeling:** Facilitates forensic identification, aids in lost and found incidents, and improves overall forensic processes.[21]
10. **Standards and Adoption:** Denture marking standards emphasize visibility, durability, and other factors. While some regions have incorporated denture labeling into academic curricula, broader adoption is recommended for efficient forensic identification.[22]

In essence, dental evidence, particularly from dentures, offers invaluable clues in forensic contexts. Proper record-keeping, technological advancements, and standardized practices can further enhance the reliability and efficiency of dental identification methods.

Discussion

Dental records and prosthodontics are integral components of forensic identification, especially in medico-legal investigations where conventional identification methods may be unavailable.[23] The role of dental examinations in such contexts cannot be overstated, with prosthodontists playing a crucial role in forensic identification efforts.[24] Their responsibility includes maintaining comprehensive dental records, proving invaluable in various identification methods such as comparative dental identification, prosthesis labeling, and DNA identification.[25] Denture labeling, a specific aspect of prosthodontists' involvement, employs multiple techniques like surface modification, inclusion, laser etching, and RFID tags, enhancing the accuracy and reliability of dental evidence in the identification process.[26]

In forensic dentistry, prosthodontics plays a pivotal role in identifying unidentified victims, addressing scenarios involving both dentulous and edentulous individuals.[27] For dentulous victims, dental features such as missing teeth and restorations become essential markers for identification. The historical cases underscore the enduring value of maintaining comprehensive dental records in forensic investigations.[28] In cases involving edentulous victims, prosthodontics aids in identification, employing methods like denture marking and palatal rugoscopy to establish identity and provide valuable clues in the absence of natural dentition.[29]

Denture labeling legislation is addressed, with some countries implementing regulations mandating denture marking as part of forensic protocols.[30] However, there is a gap in awareness and implementation, emphasizing the need for increased attention to ensure compliance with legal requirements and enhance the effectiveness of forensic identification processes.[31]

The significant role of prosthodontists in forensic odontology is highlighted, contributing to the field in various ways to enhance the accuracy of identification processes.[32] Denture labeling methods, including surface methods like scribing and advanced techniques such as ID bands, laser etching, and electronic microchips, ensure comprehensive marking, providing critical information for identification purposes.[33] Additionally, prosthodontists utilize other identification methods such as chelioscopy, rugoscopy, bite mark analysis, and DNA extraction, further amplifying their contribution to achieving accurate identification, especially in challenging and complex scenarios where traditional methods may fall short.[34]

In conclusion, the expertise of prosthodontists significantly enhances the efficacy of forensic odontology, proving invaluable in achieving accurate identification, particularly in challenging scenarios.

Conclusion

The synthesized summary and detailed exploration both underscore the pivotal role of forensic odontology and denture marking in the identification of individuals. Key insights from Forensic Prosthodontics include:

1. **Collaborative Approach:** Forensic odontologists and prosthodontists collaborate to leverage advancements and specialized techniques for accurate identifications, especially in complex situations.
2. **Denture Marking's Crucial Role:** Denture marking is a cornerstone in forensic dentistry, facilitating precise identification when traditional methods fall short. The use of various marking techniques is integral to ensuring accuracy.
3. **Technological Advancements:** Integration of cutting-edge technologies and a deep understanding of dental materials continuously propels forensic odontology forward, enhancing its capabilities in identification.
4. **Organizational Backing:** Entities like BOLD, ABFO, ASFO, and IOFOS provide essential support, fostering the growth, standardization, and advancement of forensic odontology globally.
5. **Historical & Contemporary Significance:** Denture marking is emphasized in both historical and contemporary contexts, with heightened importance in victim identification, especially after disasters.
6. **Regulatory Landscape:** While some countries enforce legislation mandating denture marking, a lack of international consensus underscores the necessity for standardized practices and global collaboration.
7. **Educational Imperatives:** Incorporating denture marking techniques into academic curricula and continuous education for dental professionals are pivotal for widespread adoption and understanding of its significance.
8. **Documentation & Databases:** Comprehensive record-keeping and establishing databases for marked dentures are crucial for facilitating rapid identifications and streamlining forensic processes.
9. **Future Directions:** Ongoing research and development efforts are imperative to refine denture marking methodologies, ensuring they remain robust, reliable, and aligned with evolving forensic needs.

In summation, the combination of collaborative endeavors, technological innovation, regulatory frameworks, educational initiatives, and research pursuits solidifies the critical role of denture marking within forensic odontology. It stands as an invaluable asset, bolstering the accuracy and efficacy of forensic investigations and offering solace and closure to families worldwide.

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