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Forensic Dental Photography – A Review

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ABSTRACT

Forensic dental photography is an integral aspect of forensic odontology, serving as a pivotal tool for the accurate documentation and analysis of dental structures in the identification of human remains. This specialized field focuses on the meticulous capture of visual records, including teeth, oral tissues, and bite marks, to support the process of establishing individual identities and aiding criminal investigations.

This abstract underscores the critical role played by forensic dental photography in producing detailed and reliable images, essential for comparing antemortem and postmortem dental records, as well as evaluating dental anomalies and pathologies. Specialized techniques, such as ultraviolet and infrared imaging, are employed to enhance the visibility of subtle features that may be overlooked using traditional methods.

The systematic approach employed in image acquisition ensures the creation of a standardized forensic dental profile, contributing to the interdisciplinary collaboration among forensic odontologists, photographers, and law enforcement agencies. The abstract emphasizes the evolving nature of forensic dental photography and its continued significance in advancing criminal investigations and providing resolution for families.

Keywords: forensic odontology, dental evidence, photographic documentation, human identification, forensic analysis, criminal investigations.

BASICS OF PHOTOGRAPHY:

Dental photography is used for a variety of purpose nowadays; the major goal of digital dental photography is to correctly document clinical symptoms of the oral cavity. Legal documentation, publication, teaching, communication with patients, dental team members, co workers, and technicians, and eventually marketing are all examples of secondary usage. Each of these applications boosts and elevates the prominence of dental practice while also improving patient care. [1]

The word photography comes from two Greek words: phos, which means light, and graphos, which means to write. Although photography is commonly recognized as the most accurate method of documenting evidence, it was not much in use until late nineteenth century. Forensic photography, often known as crime scene photography, is a specialized style of photography in which evidence and other significant items related to a crime, such as the locations of things, are recorded in a standardized manner. The photos that arise can then be evaluated to see if they're suitable for use in a court of law. All forensic photographs, including dimensional scales, must contain all important information. Digital SLR or mirror less cameras should be available to forensic dentists. Smart phone cameras and point-and-shoot cameras are unable to create the sorts of photos that are required. [4]

A functional dental picture must have two characteristics. The first is accurate colour reproduction, which involves proper exposure, and the second is enough resolution to capture both soft and hard tissue features. The picture should correctly portray the colour of both hard and soft tissues as they appear in the mouth, removing the impact of different light sources or illuminants. Correct colour depiction of soft tissue is an effective tool for identifying healthy from diseased tissue and documenting pathological changes such as white patches, inflammation, ulceration, burns, lacerations, cancer, and so on. [2] Another factor to consider is image quality, which is determined by the sensor's resolution and the capacity of lenses to catch the tiniest details. In the end, resolution equals information: the greater the resolution, the more image information there is. [3]

PRINCIPLES AND PROCEDURES OF FORENSIC PHOTOGRAPHY:

One should take into consideration the following factors when taking crime site photos:

- ✧ Securing the scene: Once the crime has been confirmed, the site should be secured in its current state; any changes to the scene photographed will be considered false evidence. [15]
- ✧ Evaluating circumstances: Light and weather conditions, as well as camera settings, should all be considered. [15]
- ✧ Shooting the scene: The photographer should use wide-angle images to capture the complete scene, followed by close-up shots to visualize the full scenario and highlight the evidence's relevance to the broader scene. [15]
- ✧ Photographing the victims: Location, injuries, and condition of victims should be highlighted while photographing the victims. [5]
- ✧ Photographing the evidence: Photographs should be taken directly at right angles, eliminating possible distance distortions for clear visualization, and each part of evidence should be photographed with scale to indicate size and without scale to show relationship with overall scene. [5]
- ✧ Setting up evidence markers: The first photo of the whole crime scene is critical to ensure that no one has tampered with it. The scene should be photographed both with and without the evidence markers. [5]
- ✧ Use of specific imaging techniques: To identify fingerprints, bite marks, and footprints, other light sources such as lasers, blue or green lights, and coloured filters should be employed. [5]

EQUIPMENT REQUIRED FOR CRIME SCENE PHOTOGRAPHY:

In order to shoot most situations and evidence, the crime scene photographer needs have the following items:

1. The camera (FIG 1) : It is recommended that you have a high-quality digital camera, ideally an SLR camera. It must have a resolution of at least 10 megapixels or higher. [6]
2. A standard lens: In most cases, a normal lens gives the optimum view. For a 35mm SLR camera, a 50mm lens is considered a standard lens. [6]
3. Wide angle lens (FIG 2): When photographing in small rooms or other constrained spaces, a wide-angle lens is required. For a 35mm camera, a wide–angle lens of 28 to 35 mm is considered. [8]

4. A macro lens(FIG 3) : Normally, standard lenses do not focus closer than three feet. To picture little pieces of evidence, you'll need a macro lens or a close–up adapter for your regular lens. A macro lens is a basic auxiliary lens that allows you to take close up photos. [9]
5. Altered light sources (ALS) (FIG 4) : Altered light sources (ALS): Many light sources such as lasers, blue/ green lights or UV/IR filter (100 to 400 nm) make evidence such as blood on dark clothes, bite marks and sperms apparent. Color barrier filters (red, yellow, and orange) allow evidence/prints/impressions to be seen. (FIG 5)
6. Use of an electronic flash: When photography indoors, outside at night, filling in shadows in brilliant daylight settings, and for illuminating evidence, electronic flash comes in handy. [9]
7. Tripods (FIG 6): For extended exposures and for placing the camera during specific forms of evidence photography, sturdy and lightweight tripods are required. [6]
8. Photo log and notebook (FIG 7) : It is critical to keep detailed records of every image taken at a crime scene. The notebook should be used to jot down various details about the crime scene. [7]
9. ABFO scale #2 (FIG 8) : In the subject of forensic odontology as well as many other forensic disciplines, the American Board of Forensic Odontology Number 2 scale (ABFO No. 2) has been the approved standard for use since 1987. In February 1987, William G. Hyzer and Thomas C. Krauss, DDS, created the ABFO No. 2 scale. The creation of a "standard photogrammetric reference scale" was pushed by the American Board of Forensic Odontology, which formally approved the scale on February 18, 1987. The scale was put into production by Lightning Powder Company in 1987, the same year it was made available for purchase. In the middle of the 1980s, Dr. Ray Rawson, then-president of the American Board of Forensic Odontology, created the ABFO Scale No. 1 scale. Dr. Tom Krauss was given the assignment to create a revised scale following the board's review of multiple adjustments. [16] The ABFO No. 2 is a photo macro graphic ruler designed to record a bite mark, skin trauma, a scene or object from an image. It is an L-shaped ruler with markings on each of the perpendicular legs. The ruler has three reference circles of equal diameter that help the investigator to keep the object perpendicularly.This is a crucial factor that determines the true size of the evidence by looking at the image/photo. (FIG 9) The American Board of Forensic Odontology created the ABFO No. 2 Scale. [9]

- "The overall accuracy of scale ABFO No. 2 is ± 0.1 mm or ± 1% for the major centimetre graduations."
- "The internal and external diameters of the three circles are 19.75 and 23.00 mm, respectively."
- "The error in placement of the three circles is within 0.25% of the nominal 80- mm separation between their centers."
- "The legs are mutually perpendicular to ± 2 min of arc."

PURPOSE OF FORENSIC PHOTOGRAPHY:

Forensic photography is done for mainly three purposes – For presenting as evidence in court (Photographic Evidence), to keep a record of imprints/ evidences found at crime site (Photographic Impressions) and to identify the criminal (Mug Shot Images).

Photographic evidence

This sort of photography is used to give photos of many types of physical evidence that may be utilized as evidence in court, as part of the case record, or by other investigators; generally, forensic results during various forensic disciplines' analysis. In addition to cameras and microscopes, forensic laboratories commonly utilize infrared, ultraviolet (UV), x-ray, or laser energy to portray details that would otherwise be imperceptible to the naked eye. It is critical, however, that such features do not affect the look and condition of the material being documented. [7]

Photographic impressions

Because photographs of imprints such as fingerprints, footwear impressions, and tool marks may be studied, compared, and searched through massive digital databases, they must meet particular requirements. [8]

Mug shots

The role of forensic artists is of utmost importance as they help in making the sketch of the suspect as described by the witness. These sketches are known as forensic sketches and can be useful in comparing with the mug shot database. Individuals who have been accused with a crime have their photos taken, and they are immediately uploaded into a master database known as mugshot database along with any other information about them. [14] Standardized lighting, backdrop, and distance are necessary to ensure consistent quality. Physical traits (e.g., hair and eye colour, facial hair, tattoos, etc.) are also correlated with submitted information, and a picture line-up is required if one is necessary. [7]

TECHNIQUES OF FORENSIC PHOTOGRAPHY:

Various techniques have been employed in forensic photography using different wavelengths for viewing different structures. They include

1. Alternate Light Imaging: (FIG 10) Alternate light imaging (ALI) is a type of photography that uses a different light source to magnify things or ailments those aren't visible to the naked eye. It's often referred to as narrow band lighting or monochromatic light imaging.[10] Alternate Light Imaging's Applications- The following are some of the forensic applications of alternative light source imaging (Spex Forensics, 2016): [11]

- Latent fingerprint detection
- Presence of hair and fibers
- Detection of body fluids
- Patterned damage in human skin
- Gunshot residue identification
- Questioned records

2. Infrared Photography (FIG 11): Near infrared (IR) light is used in forensic odontology to picture pooled blood under the skin surface that is not visible to the naked eye. IR light can penetrate at least 3 mm beyond the skin's surface, with the majority of the light being reflected back. Also, blood absorbs infrared light and becomes IR negative. As a result, the skin seems bright and the blood appears darkish in the image. Contusions and patterned injuries may be highlighted as a result. It penetrates the skin between 1100 and 1250 nm. This method may be utilized on live and dead objects. [12

3. Ultraviolet Technique (FIG 12) : UV photography, in contrast to infrared photography, employs light wavelengths of 200-290 nm to emphasize surface features of objects and skin damage.
Ultraviolet Photography's Applications- UV photography in forensic dentistry is often used in two areas.
A) Patterned skin damage identification.
B) Aiding in the identification of instances. [10]

Photographic Documentation: [13]

The following are then necessary steps to be followed for appropriate documentation:

1. Photograph should be shot in natural light or with a light backdrop.
2. Reference date and scale - Documenting the injuries with and without an evidence ruler, as well as dates to be completed
3. It is necessary to identify the individual photographed in order to prove their identity in court.
4. Establish authenticity - To establish authenticity, you'll need two things: The first is to document every step of the procedure, from capturing the image to presenting it in court, and the second is to label the recorded image to verify that it is genuine.
5. COE (Chain of Evidence) procedure - In a COE procedure, the origin, use, storage, and processing of evidence, as well as its integrity, are all properly recorded.
6. Image storage — Captured photos should be transferred to CD-R in any situation. It should be kept in a locked cabinet with limited access.
7. Keeping photographic evidence safe — Photographs kept on a computer should be password-protected with limited access. Images can also be stored on special hard drives.

Conclusion

Forensic photography is a vital instrument that helps with research, archives maintenance, and as evidence to support medico legal disputes. It creates a lasting visual record of the crime scene in the state it was discovered, and is crucial throughout the investigation. It helps to recreate the circumstances of the crime and provides with a detailed picture of the incident. The forensic dentist needs to be proficient with his equipment and have a strong understanding of photography theory in order to get these outcomes. Photographs are more precise, visual, objective, and reliable than written or spoken descriptions and sketches, as the data is fragile or perishable.
Forensic photography can also be used to discover unforeseen facts by extending the spectrum of human visibility using techniques like macrophotography, infrared, and ultraviolet photography, Consequently, the

job of the forensic photographer is vital, and they should be well-versed in the method and provide reliable recording of the evidence.

FIGURES

Fig 1: An SLR camera

Fig 2: A wide angle lens

Fig 3: Close up photo

Fig 4: Color barrier Filters

Fig 5: Fingerprint under green filter

Fig 6: Tripod Stand

Photograph Log

Date:_____

Location:_____

Incident number:_____

Supervisor:_____

Date	Time	Initials	Subject	Comments

Fig 7: Photo Log for recording details

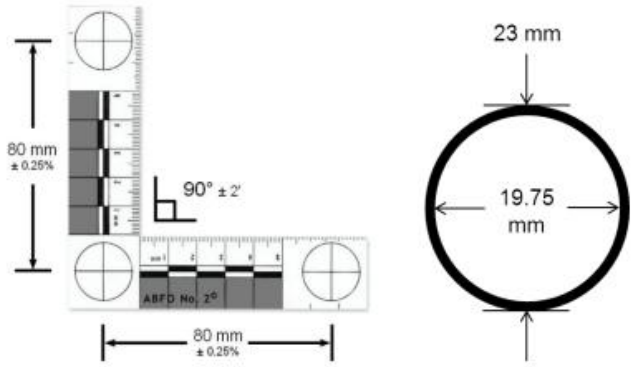

Fig 8: Dimensions of ABFO no. 2

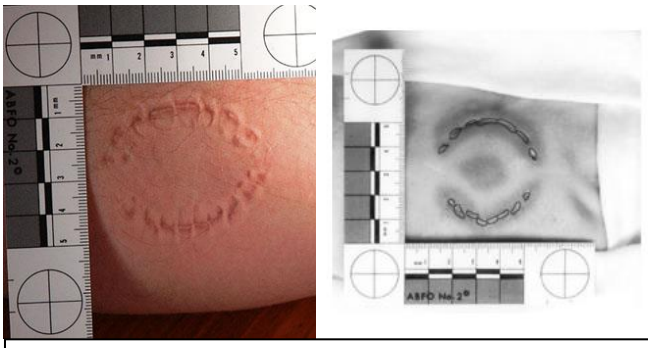

Fig 9: Measuring a bite mark using ABFO no. 2 scale

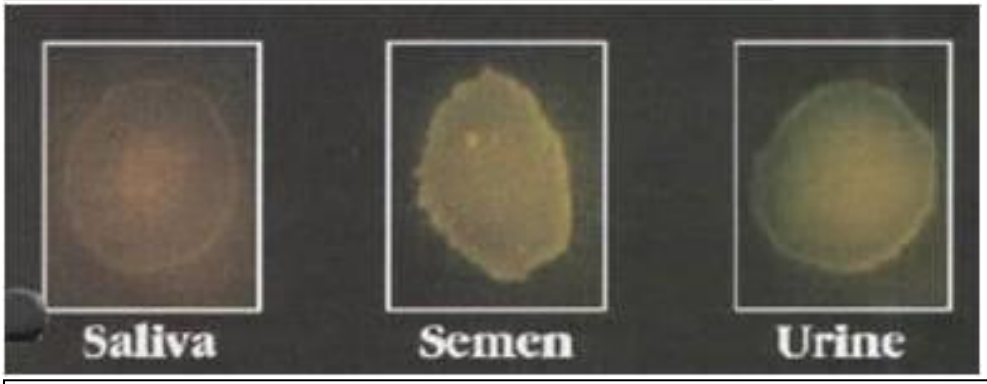

Fig 10: Magnified images of various body fluids seen differently under alternate light imaging

Fig 11: Infrared Photography being used to see things not visible to naked eye.

Fig 12: UV Technique to view Fingerprint

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