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Photography in Forensic Dentistry

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Abstract

Forensic photography or crime scene photography is an art of producing a defined reproduction of crime scene or an accident scene for the benefit of court or to aid in investigation. Photography involves choosing of correct lighting, accurate angle of lenses and the techniques to applied . Thus, it requires an adequate knowledge and skill for producing the crime scene photography to produce in the court of law for further investigation

Keywords: Bitemarks; Digital Photography; Forensic photography; Infrared; Thermographic; Ultraviolet.

Introduction

The word photography is a derivative of two Greek words: 'Phos' means light and 'Graphos' means to write. Photography is widely is acknowledged as the most accurate way of documenting evidence though it was not until key developments in the late 19th century that it came to be accepted as an essential forensic means of identification.[1]

Forensic photography, otherwise called as Crime scene photography, a specialized form of photography where evidence, or other relevant that are important to a crime, including the locations of objects, are photographed in a standardized approach.The resulting images can then be analyzed as appropriate for future presentation in a court of law. All forensic images collected must contain all relevant information including dimensional scales. Thus, this article focuses on the need for forensic photography, various types and techniques in photography and the advancements .[1,2]

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Need for dental forensic photography[3]

- Dental photography mainly shows dental remains and features bite marks. Police photographers are not trained enough to do forensic dental photography.
- Moreover, bite mark analysis requires specific dimensional control of the objects being photographed because dentist takes life sized models of a suspects teeth and superimposes them on to the crime scene evidence.
- After intense fire, carbonization of the anterior teeth renders them so fragile that they may crumble at the slightest touch. Any attempt to remove the jaws may leave the dentition in ashes. An initial photograph maintains this data if damage occurs later.
- Photographic record of injury patterns on skin is also paramount to the odontologist and pathologist. Since, vast amounts of time elapse between the commission of a crime and the trial of the perpetrator, photographs frequently are the only permanent record of the injuries to the victim.

Types and techniques in photography:[4] Divided into two types:

Visible light photography:

i) Color

ii) Black and white

Nonvisible light photography:

i) Ultravoilet light

ii) Infrared light

Visible Light Photography: Is a type of photography that uses visible light both in color and black and white.

Principle :[5]

By definition the object to be photographed is viewed through the lens and the camera automatically adjusts the focus and exposure variables before exposing the film. These types of camera have been manufactures for optimal photography in the visible light spectrum.

Two important critical considerations are lighting and film:

Lighting

Lighting can be critical to the appearance of some injuries and the use of certain film may adversely affect the results. For example, fluorescent lighting can convey a greenish tint to photographs. Also, post scene photography of injuries or fatal wounds is frequently done in bright white or stainless steel surroundings.

In low light situations, such as motor vehicle/ pedestrian accidents at night, often the only lighting may come from vehicles headlights. In such cases, the use of electronic flash or floodlighting to illuminate the scene becomes necessary.

Use of white reflective surface, which will bounce off the flash light is held at an angle above the subject. A matte finish will soften the lighting.

Covering of the flash head with a layer of white tissue or a handkerchief. This will cut the light by as much as one or two stops depending on the number of layers used.

Use of flash extension cord to remove the flash unit from the camera and hold it higher above the subject. Care should be taken to avoid unwanted shadows if the flash angle is too acute.

Film

The film must be sensitive to the wavelength of light being used to photograph the injury or else no image will appear when the film is developed. There are many quality photographic negative films manufactured, both in color and black and white.

Color is preferred over black and white film for documenting injuries. The color or change in color of certain trauma injuries can be an important factor.

a)*Visible light color photography:*[6,7] Advancements in design and manufacture of modern 35mm cameras have greatly simplified color photography. The lenses have coatings and the flash units are filtered to direct only visible light to the film. Modern films record the images in brilliant colors and sharp detail. Color visible light photography is by far the most common type of photography used today.

b)Visible light black and white photography: Changing from color film to black and white film, the forensic photographer proceeds to re-photograph the injury. When exposing film for black and white photographs the same criteria for exposing color photographs are followed.

These include film selection, bracketing, lighting, orientation and close up exposures both with and without a scale. In many situations there may only be one chance for photographs. If that is the case, take a minimum of 3 or 4 rolls of black and white and color photographs, bracketed widely, and illuminated from different angles.

Why black and white photographs then?[8]

The human eye is very adept at seeing images in color. Because of the color information processed optically by the retina, other important details of the injury may be overlooked.

When the injury is photographed in black and white, the eye is not distracted by the color composition of the injury and the normal surrounding areas. Consequently this absence of color allows the viewer to see more detail in the injury.

NonVisible Light Photography:

The appearance of the injury using non visible light illumination cannot be seen by the naked eye.

Therefore, special techniques must be employed to record the injury on film and then print the image on photographic paper for viewing in visible light.

Two important factors to be considered when attempting to photograph injuries in nonvisible light:

1.Type of film being used.

2. Light source must be strong enough to expose the film.[9]

Problems Encountered In Non Visible Light Photography:

- Difficulty in acquiring a predictable light source that emits enough of the desired wavelength to adequately illuminate the injury being photographed.
- Determining the exact amount of focal shift to produce a sharp photograph.

Ultraviolet light photography[6,10]

- Forensic investigators became aware of ultraviolet imaging of wound pattern on skin in the 1970s. In 1974,Ruddick of London hospital detailed a case in which ultraviolet .was used to record a bite mark

Ultraviolet light spectrum:

- Long UV- 400 TO 320 nm, commonly referred to black light and not visible to human eyes.
- Short UV- 320 TO 290 nm, produced by sun and couldn't penetrate atmosphere to reach earth surface.
- UVC: 200 nm,germicidial.
- Vacuum UV-Below 180 nm, air molecules absorb these wavelengths hence can only be used within a vacuum chamber.

UV light sources:

- Sunlight
- Fluorescent tubes
- Mercury vapor lights
- Flash units

Equipment for UV photography:

- 35 mm single lens reflex camera with manual exposure.
- Macro lens
- Panchromatic film having sensitivity between 300 to 400 nm.
- 3200 ASA black and white film preferred as it yield better resolution of detail than color.
- Kodak Wratten filter
- ABFO no. 2 scale.

Advantages:

- Increases the observed detail of the surface of the injury.
- An area of the injury having excess pigmentation when compared to the surrounding normal tissue can be visualized for other changes.
- Useful for the photographic enhancement of rashes and other skin disorders and also for detecting alterations in documents.

Disadvantages:

- Since the bruise or bite mark is not visible, numerous photos are needed to make sure that any possible injured area is photographed.
- Because most 35 mm cameras focus through the lens once the UV filter is in place the camera cant be focused.

Use in law enforcement

- Ultraviolet photography is used after visible light techniques and infrared light technique have failed.
- Finger prints on multicolored surfaces.
- Body sections such as urine, semen often glow when illuminated by ultraviolet light.
- Money and other valuables can be dusted or marked to identify thieves.

Infrared photography[11]

Infrared photography involves the use of high speed infrared reflectance photography. Because infrared radiation is invisible, some special techniques may be needed. But, in general, most of the commonly required methods are as simple as those of ordinary photography.

Infrared photography can be conducted in the near infrared range of 700 nm to 1000 nm using filters and an infrared sensitive recording method.

Mechanism

The infrared band of light is at the opposite

end of the light spectrum from ultraviolet band. Ultraviolet light is about one-half of the wavelength of infrared light. Because infrared is longer in wavelength transmission, it penetrates up to 3 mm below the surface of the skin to document invisible subcutaneous injury due to pooling of blood.

Infrared Light Sources Sun , Flash units, Tungsten lamps and Quartz halogen lamps

Use in law enforcement:

- Invisible subcutaneous injuries
- Aerial photography
- Surveillance photography
- Detection of gunshot powder burns,stains and irregularities in cloth
- Detection of certain types of secret writings.

Standard photographic protocols[12]

- After an assault the victims injuries may be photographed any time within the next 2 to 5 days.
- A short interview is conducted to determine the location of the injuries and how the injuries occurred. Bruises are transfer patterns. The victims statement's may be supported by placing fingers on the finger marks or blunt instruments over blunt injury bruises.
- If a weapon was used be sure to bring it to the photos session whenever possible. Rough anatomical drawings and a standardized form are used to determine the time interval for each injury. Any scars or birthmarks are also noted.
- When presented with an injury the forensic dentist or investigator must decide what information the injury may contain, the extent of the injury and how best to photographically record it.

After the interview the photographic procedure is as follows:

Place an 18% gray scale against the arm of the victim to aid the developer in assigning the proper skin tones. Also identify the victim and include a case number for reference.

Starting with visible light photo techniques, the upper half of the victim is photographed for identification purposes.

Photograph the general area or appendage where the injury has occurred.

Photographs should be taken with and without a scale.

Photographs placing the lighting source at different angles in relation to the injury should be taken.

Suggested photographs of deceased body[9,10]

1. In situ full body photographs.
2. Full face and profile photographs.
3. Photographs of anterior teeth.
4. Intraoral photograph.
5. Photographs of resected jaw specimens or skeletonized jaws:

If jaws are removed following series should be made:

A. View all recovered portions of maxilla and mandible.

B. Close up occlusal view of mandible

C. Close up palatal view of maxilla

D. Anterior view of articulated jaws.

E. Right lateral view of articulated jaws

F. Left lateral view of articulated jaws.

G. The jaws should be placed in occlusion which simulates the closing position of teeth.

Handling and documentation of photographic evidence[9]

Photo log that contains the following information:

- Case number of the agency controling the scene and evidence.
- Name of photographer his or her initials or a signature, so that, the photograph can be identified as originals and the chain of evidence maintained.
- Date and time when the evidence was photographed and the date of the incident.
- The place where the photograph was taken.
- A description of the evidence in each photograph.

Some items of evidence due to their small size require special techniques for documentation:

Photomacrography, which is the use of extension tubes between the lens and camera to increase magnification, is useful for documenting

bullets and headlamp filaments.

Photomicrography(photography through the microscope)is often used for documentation of trace evidence such as paint chips, hairs and fibers.

Photographic distortion[10]

Photographic distortion refers to an abnormality in image quality: Types of distortion;

- Lens distortion;
- Barrel distortion;
- Pincushion distortion;
- Wide angle distortion;
- Perspective distortion.

Distortion in forensic photography:

- Image distortion can occur in a photograph for a number of different reasons, including a photograph error, camera malfunction, the use of improper equipment.
- Improper placement of the camera and ruler.
- Sudden movement of live victim.
- Different effective focal length of the lens for infrared spectrum.
- Inability to see through the lens to focus on the subject due to opaque infrared filter.

Corrections: Image editing software, such as adobe Photoshop has become a powerful tool in clearing up the distortion.

Advances in photography[1,4]

Digital photography

To understand the capabilities of any individual camera, it is necessary to expose several rolls of test photographs to find the preferred camera settings for different films and ambient lighting. Digital imaging makes it possible to capture, edit, output and even transfer images faster than processing film.

It utilizes a special computer hard disk in the camera that stores the images as digital information. These images can be later written to a CDROM for storage.

Advantages

The image can be immediately viewed on a computer monitor or printed on a color printer.

The image can also be transferred to traditional photographic print films.

Ability to correct the perspective of an image as long as it contains a scale of reference.It is possible to take an image that was shot at an incorrect angle and correct it so that the scale is the same across the plane of focus.

Thermo graphic imaging

The thermograph is capable of composing a black and white image in which variations in brightness correspond to the intensity of heat emission from the human body, generally takes 15 minutes of slow scanning to build up the thermal pattern on photographic film.

A thermo graphic camera sometimes called a FLIR (forwarding looking infra red) or infrared camera less specifically, is a device that forms an image using infrared radiation, similar to a common camera that forms an image using visible light.

Conclusion

Forensic Photography is an indispensible tool in the field of forensic odontology that aids in investigation, maintenance of archives, and as an evidence which supports in medico legal issues. Hence, the role of forensic photographer is crucial and should have an adequate knowledge about the technique and accurate documentation of the evidence.

References

1. Balaji N, Senapati S, Sumathi MK et al. Forensic Digital Photography: A Review. Int J Dent Med Res 2014;1(3):132–135.
2. Gouse S, Karnam S, Girish HC et al. Forensic photography: Prospect through the lens. J Forensic Dent Sci 2018;10:2–4
3. BR Chandra Shekhar, CVK Reddy. Role of dentist in person identification. Indian J Dent Res 2009;20(3):356–360.
4. Manjunath.S.G, Raju Ragavendra.T, Sowmya.K. Setty, et al. Photography in Clinical Dentistry: A Review. International Journal of Dental Clinics 2011:3(2):40–43.
5. Forensic Photography for Crime Scene Technician. Available from: http://www.crime-scene-investigator.net/fet-ol.html. [Last accessed on 2015 May 11].

6. West M, Barsley RE, Stewart W et al. Ultravoilet radiation and its role in wound pattern documentation. Journal of forensic sciences 1992;37(6):1466–79.
7. Sargaiyan V, Bharddwaj D , Singh P et al. Forensic Photography : A Review. Int J Oral Care Res 2015;3(2):60–5
8. Bernstein ML. The application of photography in forensic dentistry. Dent Clin North Am 1983;27:151–70.
9. Bowers MC. Forensic dental Evidence:An Investigator's Handbook. 2nd ed. Burlington, MA, USA: Elsevier Ltd; 2011. pp. 287–95.
10. Wright F D–Golden G S.Forensic photography. Forensic dentistry by stimson PG,Mertz CA.1st edition. New York; CRC Press:1997.114–152.
11. Redsicker D R. The practical methodology of photography. 2nd edition. Peter Vallas Associates Endicott. New York; CRC Press:2001
12. Forensic photography [internet).Copyright 2000-2010[Cited on 2009 sep 10].http://www.exploreforensics.co.uk/forensic-photography