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Abstract

Forensic Odontology requires the use of photography for either evidential or investigative purposes. Smith in 1970 said the photographer is expected to produce “something which will convey to the eye of the viewer an accurate reproduction of the scene as it would appear if the viewer actually saw the scene”. If the depictions are precise, the photographs will play a vital role and will be readily accepted as evidence.

It is the assumption of dentists that only their counterparts who have specialised in forensic dentistry can contribute to the field. This misconception is an important reason for the limited contribution by dentists to the field of forensic science. This paper aims at explaining the role of a dental practitioner towards forensic photography, and how he/she could play a pivotal contribution towards forensic evidence.

Keywords: Photography; Forensic.

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Introduction

Forensic odontology requires the use of photography for either evidential or investigative purposes. Smith in 1970 said the photographer is expected to produce “something which will convey to the eye of the viewer an accurate reproduction of the scene as it would appear if the viewer actually saw the scene” [1]. If the depictions are precise, the photographs will play a vital role and will be readily accepted as evidence.

Importance of Records

All of us are aware of the importance of photography in bite mark analysis, study of palatal rugae, lip prints etc. in establishing forensic evidence. In addition to these, maintenance of records is a vital contributor to comparative identification. A photograph

is a more permanent and obvious record of the patient's dental findings than penning down of details or a study cast. It would serve as excellent pre-episode evidence that could be compared to those of the suspect or the victim. A practitioner thus could contribute to comparative identification by maintaining photographic records of the patient's dental findings, prostheses given, fillings placed and other intraoral pathologies. It is the lack of maintenance of permanent dental records of patients in India, which has limited the contribution of dentists towards forensic science. A detailed analysis of injuries, lip bites and bruises and finger nail marks in the head and neck region is also necessary in cases of human or child abuse. Photographs play a vital role in studying these regions of injury and many a times, a dentist could identify a unrevealed case of human abuse [1]. A pre and post operative photograph of dental procedures to establish justification from the side of the practitioner in cases of fraudulent professional negligence claims.

Basic Armamentarium

- Camera (35 mm is commonly used)
- Normal lens (50 to 60 mm)
- Wide angle lens (28 to 35 mm)
- Close-up lens with accessories
- Filters
- Flashlight
- Electronic flash
- Batteries
- Tripod
- Film (color, black and white)
- Scales or rulers
- Gray card
- Photo log sheets
- Labeling materials (pens or markers)

Consent from the Subject

Precise consent of the patient (in case of photography for record maintenance) and victim (in cases of abuse and other crimes) should be acquired before taking any photograph. The subject should be explained about the kind of pictures that will be taken and for what purposes and the subject should be informed that the photos may be disclosed in the court of law, if required. Similarly, the subject should be aware that the pictures may be used for publication in medical journals [1].

Basic Principles in Forensic Photography

California Medical Training centre advocates few principles in forensic photography to shoot photographs that will be accepted by the court as evidence:

- More than one victim/subject/suspect should not be photographed in one roll of film.
- Each film roll should start with a facial view of the individual.
- Backgrounds that are brightly lit should be avoided since it may result in wash out of details [2].
- For findings on the extremities, a blue or green surgical towel can be used as a backdrop. Taking pictures in a colourful or crowded background will result in colour reflection and camouflage.
- The finest lens for recording injuries or pathologies is a macro lens with a focal length of 100-105mm.
- The plane of the lens and the plane of the finding should be parallel to each other. If the finding is on curved surface (palate, nose, etc.) multiple shots should be taken.
- If the findings are textured (swelling, indentations, laceration, etc.) supplementary shots in tangential or oblique angles should be taken.
- At least three photos of every finding should be taken.
- A regional shot that educates the viewer regarding the general location and position of the finding on the body should also be taken. The aspect must be wide enough to include some important anatomic landmarks in relation to the findings [3].
- At least one zoom-in shot with a scale adjoining the finding is mandatory. Zoom in or close up shots are taken at a distance of 10 to 12 inches or 25 to 30 cm from the site to be captured [1]. The scale and the film plane should be parallel to each other. The victim/subject/suspect identification number should be on the scale. L-shaped rulers are vital while capturing bite marks. Scales should not be placed in all photos, as it may lead to a concern that something is concealed.
- In cases of crime scene photography, photographs of the location and surroundings of the crime scene also should be taken.
- The identification of the person photographed should appear on every picture either as a full name or a case number. Non identifiable pictures are of no value in court.
- It is important to date the picture. Recent cameras have a date feature. In some situations, a practitioner should bear in mind to take a picture of the patient/victim with a recent newspaper as a proof of date [1].
- Film negatives should not be exposed to heat or light which may decay the films. They should be stored in a lock and key, with restricted access.
- Access to the negatives, photographs or CDs, hard disks

and flash drives in case of digital photography, should be recorded in a log book with the person's name, date, time and purpose of access. Digital storage should be password protected [1].

- Photographic skills can be improved by peer review for technique as well as content and interpretation.
- Utmost secrecy and confidentiality should be maintained during developing, storage, recovery and analysis.

Digital Photography: Pros and Cons

Digital imaging provides potential new means for securing, analyzing, and storing records of photographic evidence. These tools supplement the conventional video and still photography used in documentation of evidence. The advantages of digital photographs are instant access, easy incorporation into other available electronic technologies, overcomes the ordeal of expensive film processing equipment and darkrooms. Drawbacks in using digital photography revolve around issues of court acceptability due to easy image manipulation. Nevertheless, it is essential to remember that it is the investigator who testifies and not the image. Written and executed policies for usage of digital photography in forensic science eliminate this disadvantage. The judicial community agrees that digital imaging in forensic documentation can be used as a supplemental method and not completely substitute the conventional techniques.

However, pictures taken from mobile phones are not accepted in judicial settings as the quality of the cell phones pictures is not really sufficient for judicial purposes. The image resolutions or sizes are not good enough to print big pictures. Also, as the mobile phone lens has a wide angle, the images can be distorted on the sides [1].

Authentication of Image

Two methods of image authentication are possible: a) an *audit trail* for conventional photography which records the making of an image from the time it is shot to its presentation in court and b) *watermarks* and *digital signatures* for digital photography on the image at the time of capture [4].

Special Techniques

Infra Red Photography

For Infra Red Photography, an infrared filter is placed over the lens, to ensure that only red light is transmitted. A number 87 infrared filter or a gelatine filter should be used. The advantage of Infra Red Photography is that, lighting is not a very important influencing factor; near to adequate light would suffice. Infra Red Photography is used in bite mark analysis to study the depth of the bite into the dermis and underlying vasculature [5] and identification of bruises after they have become invisible to the naked eye [6]. It is also an extremely important tool in studying blood stains clearly on a textured or darkly coloured fabric [7]. Infra Red Photography is used in documentation of faded tattoos [8].

Image Subtraction Techniques

Image subtraction techniques have been used in comparing bite-wing radiographs [9]. Image is subject to background subtraction

and image inversion. The digital radiograph of the victim/suspect is set to 50% opacity. As this value is altered gradually the dissimilar areas would be seen clearly on comparison with the inverted image. If the images are completely identical, they would cancel one another [10]. Image subtraction and inversion techniques are also useful in recognising footwear prints, dust marks or other stains in a camouflaging background.

Alternative Light Source Photography

Alternative Light Source (ALS) photography is a technique wherein a tunable multiwavelength emitter is used that can be calibrated to emit a specific wavelength of light. The wavelength of light chosen should be able to result in peak fluorescence of the background of the image to be captured, while suitable filters are placed in front of the lens to filter the light emitted, so that the area of focus will be enhanced by emission of lower frequency of light. ALS techniques are used in analysis of bite marks [11], fingerprints and identification of white restorative materials such as composites [12].

Flash Fill Photography

In flash fill photography, the camera's shutter speed is set in accordance to the flash synchronisation speed. Using the camera's light meter, the correct f number (*the f-number of the camera is the ratio of the lens's focal length to the diameter of the entrance pupil. It is a dimensionless number that is a quantitative measure of lens speed, an important concept in photography*) is set for the lens and the flash to subject distance is determined for the particular f number and the image is captured. Flash fill photography helps to capture details in areas concealed by shadows in a normal image. It is hence an extremely useful tool in intra oral photography, where posterior areas are usually shrouded due to shadowing [13].

Conclusion

Knowledge of basics in forensic photography is essential to a dental practitioner to enable him to contribute to forensic evidence collection, and an insight into special techniques was given in this article to emphasize the scope of photography in forensic dentistry.

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