Documentation and Photography for Breast Cancer

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15.1 Introduction

Medical visual documentation is a concept of taking medical still images called as photographs and recording medical movies obtained in clinics, outpatient clinics, and operating theaters that are used in many branches of medicine. Medical photography is the main branch of medical visual documentation. Photomicrography and fluorescence images are used in microbiology; intraoral photographs are used in dentistry; ultraviolet images are used in dermatology; fluoroscopic images, tomography, and magnetic resonance images are used in radiology; endoscopic images are used in endoscopic procedures; and photogrammetry and contour mapping are used in anatomic and diagnostic medicine. Medical photography also emerges as a concept that takes its place in the concept of medical visual documentation and begins to appear in the literature. Besides these, public relations, health insurance, and academic purposes are other areas where medical photography is widely used.

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Today breast cancer is also an important mortality cause in women. So, breast surgery plays a great role in medicine. For successful surgical practices, education, and treatment of breast surgery, standardized, high-quality photographs have become an essential component of success. This article mentions how to obtain the best and high-quality medical photographs in breast surgery. We aim to provide a set of rules and suggestions of essential components that will help breast surgeons to obtain appropriate and high-quality photographs for better education and treatment options.

15.2 History of Documentation and Photography in Medicine

"Photography" word was used by William Herschel (1792–1871) first time in the literature, as a combination of the Greek words "fotos" and "grafos" meaning "writing with light." In other words, it can be interpreted as "leaving a trace with the help of light" [1].

The history of medical photography is rich and tracks the evolution of both technology and medicine. In the early 1800s, the advent of photography made a positive impression in the field of medicine. The world's first application of photography to medicine was in 1839 by the French physician and cytologist, Alfred François Donné (1801–1878), credited for the

M. Rezai et al. (eds.), *Breast Cancer Essentials*, https://doi.org/10.1007/978-3-030-73147-2_15

first photomicrograph [2]. In the field of surgery, Hermann Wolff Berend created some of the earliest known preoperative and postoperative photographs of patients requiring orthopedic surgery in the 1850s [3].

Just after a few decades that the first photography was taken, the first medical photographs were printed in a medical journal by Gurdon Buck. It was about the first preoperative and postoperative photographs of plastic and reconstructive surgery [4]. These images were the first real form of photography called daguerreotypes that were accomplished through a lengthy chemical interaction between bromine, iodine, and chlorine to generate a picture. Later in years, Charles Gilbert reported several cases in the *American Journal of Dental Science* using photographs to demonstrate preoperative and postoperative results of reconstructive procedures [4]. The first medical photography department in the United States was established by Oscar G. Mason in the mid-1860s at Bellevue Hospital in New York City, the nation's oldest public hospital [5]. The earliest photography in a medical book was by James Balossa who was a surgeon in 1863 [6].

In 1955 during the first international congress of plastic surgery, Sir Harold Gillies reported the use of photography in medical applications as the greatest advancement in plastic surgery [7]. As seen through the historical evaluation of medical photography, the first usage of photography in medicine was all at the plastic and reconstructive surgery branches.

As the technology developed and advancements in computer and film technology improved, digitization of photographs appeared in nearly the 1980s. Until that time professional photographers working at the medical centers were responsible for taking medical photographs, after digital technology enters the life as a modern era, doctors especially surgeons took that work by themselves [8]. Photography's application to medicine has become increasingly multifaceted with the advent of digital photography, smartphones, telemedicine, and the ease of photo sharing and storage. With the advent of digital cameras, there is fast dissemination of medical photography into the educational and research fields of medicine. Today all physicians and medical professionals especially surgeons use medical photography mostly intraoperative photographs, clinical photographs, and specimen photographs as an educational tool and to help evaluate outcomes. Photography was among the first wave of medical documentation in which the subject's condition could be more objectively portrayed, minimizing artistic interpretation. Throughout its history, it has become a valued adjunct to patient care, research, and education.

At the end of these developments, the concept of medical photography has become a new meaning. The need for education has been born to obtain high-quality results and to obtain these images meaningfully. Today, there are educational programs in this regard in various universities around the world for this purpose. The aim of these certification programs and the trainings offered at various centers is to educate individuals who can take the place of hospital photographers in the past and are educated in medical photography. In addition to theoretical information such as basic photography education, medical photography as a document, ethical and legal sensitivities, photo processing, and backup, the certificate program has practical applications in laboratories, polyclinics, clinics and operating theaters, and studio applications in short courses.

15.3 Importance of Documentation and Photography in Medicine

Medical imaging is heavily used in all three basic fields of medicine, internal sciences, and surgical sciences in the modern world, where the visualization is fully felt. In addition to science branches where macroscopic images such as anatomy are important, medical photographs are also used extensively in science branches where microscopic images such as microbiology and histology are of primary importance. Pathology is a science that needs both photographic and macroscopic photographs at the same time.

Medical photographs are a frequent application for diagnosis of the disease/lesion and follow-up of the response to treatment in hospital practice. The imaging of various stages of the disease and the detection of wounds, stains, and body deformations are the main uses of medical photography. In cases where reports are inadequate, autopsy and crime scene photography are also important because they are evidence-based in the practice of forensic medicine. Medical photography is also an indispensable source in the identification and evaluation of trauma and injuries. In surgical procedures, especially before, during, and after the surgery are within the application fields of medical photography. Sometimes endoscopic images can be recorded to photograph internal organs. A tube with a light source and a lens can be taken by connecting to the body of a camera so that the patient's pharynx, stomach, or large intestines can be visualized.

Medical photographs and videos which are used for educational purposes are so important, and separated title should be opened. Visualization is especially important in the education of medical faculty students. In addition, visual materials are frequently used in specialist training and postgraduate training. Medical photography is very privileged in the introduction and development of techniques in surgical sciences or in dentists requiring surgical procedures.

Medical photographs used in academic publications and presentations have great importance for further elaboration and appreciation of the work. Medical photographs also have an important place to create personal archives of physicians for judicial or medical reasons and to follow their patients. In addition to informing the public in written and visual media and social media, medical imaging is the most important reference material for patient education and illness.

Besides these, photography of medical instruments and devices and some graphic and artistic interpretations, you may also need to view drawings made for publications and presentations. If they work in the health field, for themselves, and if not, they record the health professionals' medical aid and training. In addition to photography, there are videoconference or telemedicine (remote medical consultation) areas of study to produce and present moving images. Sometimes the medical photographer may have to take photographs of patient-physician relations for the hospital. This includes photographs of award ceremonies or famous visitors especially for the hospital.

Of course, it cannot be expected that a medical photographer will have detailed knowledge and skills about all these matters. However, for satisfactory results, it should be familiar with these issues in part.

15.4 Importance of Documentation and Photography in Breast Cancer

Breast surgeons present their clinical work at conferences featuring photographs that are blurry or containing blood-stained backgrounds or extraneous surgical instruments with no care to the subject of the photograph. All these oversights detract attention from the theme the photographer is trying to depict and diminish the educational value that a picture is able to provide. Even the best presentation can be compromised by a poor series of photographs, and this same concept applies to medical textbooks and journal manuscripts.

There are many advantages to obtaining high-quality photographs in medical settings for breast surgery. The main advantages are listed in Table 15.1.

It is now generally understood that high-quality photographs should be obtained in the clinical setting so that to provide documentation before and after operative intervention. In addition, it is important to remember that the goal of medical photography is to present the subject in an accurate and precise fashion, rather than a favorable manner as is done in portrait photography [9].

Table 15.1 The main advantages to obtaining high-quality photographs in medical settings for breast cancer

Photographs can be used for scientific presentations and manuscripts
Preoperative and postoperative photographs can be used to demonstrate functional deficits or improvements and operative results
Photographs provide a tool for evaluation by the surgeon
Intraoperative photographs of procedures and specimen photographs provide evidence and examples that can prove important for education, communication, and medicolegal purposes

15.5 Concepts of Photography in Medicine

The concept of medical photography requires three basic elements in terms of achieving good quality and appropriate medical images. Those are basic photography knowledge in medical photography, features of the medical subject (object) and medical sensitivities, and ethical-legal issues. If these three basic concepts are followed, medical photographs would be of good quality and appropriate for the purposes [10–12].

To take high-quality photographs in breast surgery, firstly the basic concepts of photography must be known. The camera and its equipment, exposure, and its components are the main issues that affect the quality of photography.

15.5.1 Basic Photography Knowledge of Photography in Medicine

To obtain a quality medical image, a good basic photography knowledge is needed first. Basic photography is an overly broad concept and requires theoretical and practical training for weeks or even months. However, for medical photography, there is no need to know basic photography knowledge at such a wide level [13–15].

15.5.1.1 Camera Body

First, the hardware to be used in medical photography needs to be recognized and mastered in detail. It would be appropriate to use advanced amateur or beginner-level professional digital cameras in the shootings to obtain good-quality images and to adjust the basic photography rules [14, 16]. In today's technology, the technical features of mobile devices such as mobile phones, tablet computers, and so on, which are designed like commercials, can never be answered to the need. The use of these devices in medical photography is not appropriate, as basic photography settings cannot be adequately achieved with these devices. The machine to be used must be digital single-lens reflex or mirrorless. These cameras are designed to allow you to change the lenses for the desired shooting, allowing you to make the necessary settings for taking the right pictures. They also have ideal resolution values for small-sized (postcard size) prints, as well as for use in digital media such as computers, slide presentations, social media accounts, and televisions. The new generation of sensors ensures that the view is accurate and of good quality even in low-light conditions [17, 18].

The ideal camera for medical photography in breast surgery should feature a large sensor size which permits more light per pixel, thus providing better images. Preferably digital single-lens reflex (DSLR) cameras or mirrorless cameras are the best cameras in this issue. The digital cameras with 10 megapixels (MP) or high with a higher range of contrast as well as better color depth are the best choices. For obtaining photographs in the medical setting, a camera that is easy to operate with a powerful flash that is bound to the hot shoe of the camera is preferred. Also, for specimen photography, extra ring flashes that are connected to the hot shoe of the camera give the best results. For intraoperative photography, it is greatly beneficial for the camera to have a swivel screen that will enable the operator to shoot at a wide array of angles.

15.5.1.2 Lens

Another important element in photographing is the lens. The lens is a collection of lenses that allow the light from the image to fall on the sensor of the camera properly. According to focus distances, standard/normal lenses have short

focal length lenses (wide angle: 35 mm, 21 mm, etc.), long focal length lenses (narrow-angle telephoto lens: 70 mm, 200 mm, etc.), and the closest focal distance to the eye (normal angle: ~50 mm) [12, 17] . In medical photography, short or long focal length lenses are used because they are practically taken from short distances. Macroscopic lenses (called "micro" in some brands) should be used to obtain a detailed view of small lesions, especially in specimen photographs and dermatologic lesion photographs.

When the lens is selected, the line splitting force of 1 mm should be high, and those with bright and dark shots should be sharp (contrast, acutance). In low-light conditions, such as the outpatient room where auxiliary light sources are not available, the lens is even more important. In such cases, high apertures (e.g., f1, f1.4, f2, f2.8) are needed to further reduce the light sensor. The lens with high apertures is called "fast" and is the type of lens that should be preferred in medical photography. Aperture is also one of the factors that affect the "net depth of field" [19–21], which also shows the area behind 1/3 front and 2/3 of the photographic object.

The quality of a lens is determined by two fundamental parameters, the aperture and the focal length. A lens with a larger aperture is preferred for medical photography. A standard zoom lens with a focal length anywhere between 14 and 70 mm is acceptable to frame and obtain pictures quickly and properly.

Lenses are divided into two groups mainly as prime lenses and zoom lenses. A prime lens has a focal length that is fixed, but the zoom lenses have different focal lenses which allow to zoom the object. This is also called as the optical zoom in photography. With prime lenses adjusting might be difficult. The fixed focal length forces the photographer to change shooting positions to focus on an object and achieve the desired photograph, and therefore this lens is not recommended for medical photography. But with a zoom lens, adjustment might be done without changing the position. This is important in medical photography especially for operative photography that you have less area to move.

The zoom capability of a camera can be divided into two categories, optical zoom and digital zoom. Digital zoom functions to digitally alter an image by enlarging and cropping a portion of the image to achieve the effect of magnification. Digital zoom is not a real form of zoom because it only enlarges the existing pixels of an image instead of adjusting the lens itself to create a new image. Owing to the mechanical constraints of digital zoom, the result will always be a lower-quality image. Optical zoom, on the other hand, is achieved by adjusting the magnification optically through the lens, serving to bring the object closer. Optical zoom will result in a clear, high-quality image even at longer distances since it has the capability to focus on distant objects. For medical photography, optical zoom is always preferred over digital zoom. If using a camera with digital zoom, it is not recommended to use the zoom feature, but instead the picture will be clearer if the camera is simply moved

closer to the object being photographed.

15.5.1.3 Lightning and Flash

It is noticeably clear that the basic meaning of the picture should be the correct use of light, since the meaning of the word is "write with light." Light sources may be as natural as the sun and can also be artificial as the bulb, fluorescent, flash, and paraflash. The most frequently used auxiliary light sources are flashes when natural light is inadequate in photography. These are generally flashes integrated into the camera or connected to the upper hot shoe (Fig. 15.1) [22, 23].

Because medical imaging applications such as dermatology and plastic and reconstructive surgery require a frontal view, especially macro shots, ring flashes preferred macro shots to be used [24, 25]. In this way, there will not be any shadows that will lose detail, especially in face, lesion, specimen, or tissue shots, because it will illuminate all around. To reveal these features of the raised lesions on the surface, it will be necessary to use the light coming from the side at 45 degrees, not just from the opposite side.

Particularly in dermatology photography or portraits, there is a need for a shooting room in

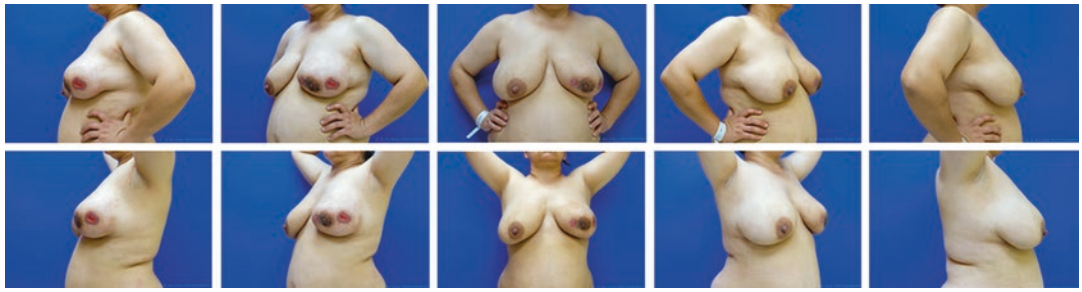

Fig. 15.1 Ten poses setting of clinical breast photography

the form of a photo studio. The blue or green antireflective backdrop, which contrasts with the skin color and makes the details and contours more distinctive, is the light source required for this purpose in order to prevent shadowing by 45° angle with two legs. In addition, white balance adjustment from the camera is required to obtain near-realistic color quality compared to the type of auxiliary light used [16, 26].

Lighting is a crucial factor when taking high-quality photographs. Standardized photographs require appropriate light sources to provide optimal contrast and detail of the anatomy, functional posture, and appearance of the breast. As previously described, a large image sensor is ideal, especially under low-light conditions. Generally, under the same light conditions, images taken by a camera with a larger-sized sensor are of better quality due to a smaller amount of "noise" being picked up by the camera. Image "noise" refers to the random variations of color and brightness that degrade image quality, caused by extraneous information picked up by the electronic sensor of a camera. In a well-lit room, the built-in flash on a camera is sufficient to produce high-quality photographs. In poor lighting conditions, the built-in camera flash tends to create shadows and uneven lighting, and a longer exposure time is needed which will likely result in a blurred image. In addition, a larger aperture is required to achieve sufficient light exposure, but this can decrease the depth of field and possibly result in blurred images. Therefore, in this condition, a small-sized and lightweight external flash or ring flash should be considered to help produce acceptable preoperative, intraoperative, and postoperative images [23, 27]. The amount and angle of light from the camera flash and external sources should be held consistent to produce comparable photographs [28].

15.5.1.4 Other Equipment

Apart from these basic items, computer and photo manipulation programs are also needed to evaluate and process high-capacity hard drives and data for storage and backup of data, tripod to be used for fixing the camera, ruler to be used for scaling, and memory cards in suitable capacities for data storage [29].

15.5.1.5 Exposure and Its Components

The basis of the basic photography concept is exposure. The meaning of the exposure is to "adjusting the light." In photography it is the name given to the effect of light on a sensitive material and is provided by three basic concepts: aperture, shutter speed, and ISO (International Organization for Standardization).

Diaphragm (shutter, aperture) is a structure in the lens that adjusts the amount of light passing through the lens. "f" is expressed as a value. As the "f" value increases (f11, f16, f22), the diaphragm aperture decreases, and the amount of passing light decreases. As the value of "f" decreases (f5.6, f4, f2.8), the diaphragm aperture expands to reach more light sensors. Shots with too much aperture are brighter, shots with less aperture are darker. This also affects the net area in the image; as the aperture decreases, the net area decreases, and the background becomes blurred [29–33]. In medical photography, lenses

with a wide range of diaphragm aperture should be preferred, especially since the net depth of field is also important.

Another important element in the exposure is the shutter speed (shutter speed) which is used to adjust the duration of the light falling on the sensor. It defines the opening and closing speed of the screen in front of the sensor and is expressed in "1/second." As the curtain speed increases (1/500, 1/1000, 1/2000), the lightness of the curtain becomes shorter, so that less light enters the image, and darker images are obtained. As the curtain speed decreases (such as 1/60, 1/30, 1), more light enters the image, and a brighter image is obtained for the curtain aperture open space. Curtain speed is primarily used in obtaining moving images. When an object in motion is photographed at a low shutter speed, the object is recorded with motion irregularity, while a high shutter speed is photographed while motion is frozen, recording the object still [29–33]. Apart from the surgical photographs in which the hand movements enter into the image, the curtain speed setting is not needed very much because the photographs taken in medical photography are made for still objects such as a lesion, the face, and a specimen. For this reason, it is more practical to give the "aperture priority" shooting command to the camera in terms of practicality. With the aperture priority command set in the camera, the optimum shutter speed corresponding to the diaphragm aperture suitable for the photographer is automatically assigned by the machine. So, you do not have to deal with an additional setting for correct exposure in taking pictures.

The International Organization for Standardization (ISO), an effective last resort for exposure, is an international standard that is sensitive to light. At lower ISO values (such as 40, 100, 200), the sensor acquires fewer sharp images. The International Organization for Standardization (ISO), an effective last resort for exposure, is an international standard that is sensitive to light. At lower ISO values (such as 40, 100, 200), the sensor acquires less sharp images [29–33]. At higher ISO values (such as 1000, 3200, 6400) while the sensitivity of the sensor is increased, while sharper images are obtained even though the sensitivity of the sensor is reduced. The ISO 200 value is the recommended value for quality imaging in medical photography. If the ambient light or auxiliary light sources are insufficient, it is necessary to fix the camera with a tripod or increase the ISO values to avoid the possibility of shaking or darkening of images at ISO 200 value. At higher ISO values (such as 1000, 3200, 6400) while the sensitivity of the sensor is increased, while sharper images are obtained even though the sensitivity of the sensor is reduced. The ISO 200 value is the recommended value for quality imaging in medical photography. If the ambient light or auxiliary light sources are insufficient, it is necessary to fix the camera with a tripod or increase the ISO values to avoid the possibility of shaking or darkening of images at ISO 200 value.

It is important for the camera operator to have a basic knowledge of the camera and associated lens equipment. Proper aperture and shutter speed are critical for obtaining high-quality photographs, especially when attempting to highlight the minute details of multiple structures in a small space, such as an axillary area [34]. The aperture is the diameter of the opening in the lens and controls the amount of light that passes through the lens, thereby determining the depth of field. The depth of field is the area between the closest and farthest objects in an image that will appear sharp in the picture and is quantified as an inverse ratio to the aperture. The aperture is typically designated by a specific f-number (f is the focal length of the lens), and the camera can be set to a series of f-stops that will adjust the depth of field 35]. A large aperture, such as f/2.8, will result in a shallow depth of field, and the camera will only focus on a small area, while leaving the background out of focus [28]. A small aperture, such as f/8, will produce a larger depth of field, enabling the camera to keep the entire scene in focus. A large depth of field is preferred for medical photography to capture all the important anatomic and functional details of a subject [28].

The ISO number is a measure of the film speed in a digital camera, determined by the sensitivity of a camera's sensor to light. Typically, digital

cameras will have ISO numbers ranging from 100 to 6400 and too much over with the nowadays technology, with high numbers representing a greater sensitivity to light. The higher ISO numbers are accomplished by amplifying the image signal and image noise. When most point-and-shoot cameras are set above 400 ISO, the image noise may be increased to a level that can drastically reduce image quality. To prevent image quality reduction, it is suggested to keep the ISO under 400, with a recommended setting of around 200.

For clinical and intraoperative photography, we prefer the aperture priority mode, which allows the user to choose a specific aperture value while the camera selects a shutter speed to match. This mode can easily provide a consistent depth of field, an important consideration when taking medical pictures. It is difficult to recommend a specific aperture number because the lens aperture varies by focal length, but a good general rule is that the lower the f-stop number, the larger depth of field the camera will provide. For a modern high-quality point-and-shoot digital camera, an aperture setting ranging from f/4.5–f/5.6 is adequate to achieve a sufficient depth of field. Aperture priority mode with the "macro" setting on can be helpful for intraoperative photography when the camera is positioned close to the subject. The "P" mode with the "macro" setting on makes it convenient to obtain radiographic film photographs.

Once the optimal mode for the photographer has been established, each photograph should be taken with the same settings to provide consistent photographs.

15.5.1.6 White Balance

The human brain normally adapts to the light of different temperatures reflected from different light sources in the environment and allows the colors in the environment to be detected correctly. However, it is seen that some of the photographs taken with traditional film photographic machines are in extreme red-orange or blue tones. This is due to the inadequacy of the photographic machines to distinguish between different colors of the heat. There are various options for white balance. The automatic white balance (AWB) is an option that does not always give the right result. In the automatic system, the camera adjusts to the lightest spot in the environment and takes that spot as white, balancing the other colors based on that spot. The automatic setting should not be preferred except for experimental/artistic photographs taken aiming to play with colors. However, nowadays, it is possible to obtain true colors in computerized arrangements later on by using the automatic option, especially when there are different light sources due to "bright room" facilities such as photoshop [29–33].

Among the options outside of AWB are cloudy weather, cloudy weather, shade, flash, tungsten, and several types of fluorescent media. Using these options, it is important to define the colors in the right direction.

15.5.1.7 Composition

In taking medical photographs, it is necessary to comply with basic photography compose rules such as "simplicity," "1/3 rule harmony," "balance," and "framing" [33].

15.5.1.8 Background

The background of a surgical picture can have a substantial effect on the quality of the photograph. An ideal background must not be distracting and should always feature the same tones when used in a series of pictures. Previous studies have shown that either a medium or sky blue tone background is an acceptable color [35, 36]. We prefer to use the same size 60 cm by 40 cm green surgical towel as a background for all pre-, intra-, and postoperative photographs whenever possible. We recommend removing any creases or wrinkles that are disrupting the background material before pictures are taken, as this can decrease the overall quality of the image. In the clinical setting, we iron a green towel to remove creases and wrinkles. When obtaining intraoperative images, because we are not able to iron the sterile green surgical towel, we simply pull the corners of the towel tightly to minimize or remove creases and wrinkles. As previously mentioned, any debris such as surgical instruments,

gauze, and blood should be taken away from the focal point of the picture to avoid the potential for distraction by the viewer.

15.5.1.9 Image Editing

After obtaining medical photographs, it is imperative to properly format the image to attain the highest-quality product. Images should be oriented in the same plane that a surgeon would view them when in a similar setting. Clinical pictures and radiographs downloaded from a database (X-rays, CT, MRI), should be oriented vertically. However, in the operating room, the picture should be oriented horizontally because this is the view the surgeon will see while operating.

It is not appropriate to publish pictures that are at random angles, as this can be confusing for the reader, and therefore images should always be rotated vertically or horizontally to a 90-degree angle. It is also recommended that images are digitally cropped, leaving only the essential aspects of the photograph, and measures should be taken to crop or cover a patient's face or eyes because these elements have no relevance to a hand condition.

15.5.2 Features of Medical Subject (Object)

To obtain a correct medical image, attention should be paid to the characteristics of the medical subject as well as basic photography knowledge.

Lighting must be provided in accordance with the subject. Light intensity and arrival angle should be adjusted very well. Medical details should be avoided to prevent shadowing. Attention should be paid to the distortion of the perspective. Care must be taken that the sensor of the photographic machine is parallel to the subject and that there is no angulation to distort the perspective. For the right perspective, it is preferable to approach the subject as physically as possible [37, 38] instead of zooming in.

It is especially important to manage distracting images of medical subjects. Attention should be paid to items such as clothing, jewelry, makeup, and hair that will provide recognition of the medical subject, which will lead to the targeted image in the medical subject, and a simple composition should be attempted as much as possible. Ethical censorship of the patient's eyes is not enough. Unless the pathology itself is, moles should not be imaged to the patient's unique signs, such as tattoos. Care must be taken to ensure that the background is plain and clean and suitable for color enhancement. Whenever possible, a blue or green background curtain or covering should be preferred. The camera should be an average of 1 m away from the subject, and if the elements of the face or body are to be photographed, it should be about half a meter distance between the subject and the fund. Body parts such as hands, arms, and legs should be photographed directly on the cover. In surgery or specimen shots, medical items such as bloody gauze, surgeon's hands, and retractors should be excluded. If this is unlikely, then shooting should be done only after such confusing elements are concealed by a cover. Sorting should be done during shooting as much as possible, and it should be used as a last resort to remove such elements by computer trimming with computer programs [37, 38].

In portraiture-type photographs, patients should be contacted with eyes, images should be taken after the purpose is explained, and images taken afterwards should be shown to the patient [37, 38].

Patient safety and sterilization are the fronts in the operating room. Because sterilization of the photographic machine cannot be considered, the operation table or subject should be approached by standing at least 30 cm away from the team or the operating table. If the surgeon is going to make his own shot, he should continue using the camera by wearing a second glove and removing the second glove at the end of the shooting or removing the surgical shirt and wearing the new one. In the operating room, medical photograph training is given to the other members of the team such as assistant health personnel, nurse, and assistant doctor in clinic and outpatient settings, and it is very important to get support in these

shootings and to obtain correct and acceptable photographs.

The ruler must be used for the actual size of the lesion, specimen, and tissue images. Elements that guide the size, such as the injector, medical device, etc., should not be preferred. They can disturb the light perception of the camera with the effect of glare, and they cannot give exact results like the ruler about the actual size [37, 38].

15.5.3 Medical Sensitivities and Ethical-Legal Issues

The capture and use of medical photographs require special precision. Medical photographs are different from other images because they permanently identify the patient's identity in an undesirable situation.

Because even if these images are ill, the situation is in the ability to "freeze" forever. Medical photographs may contain information that the patient would always prefer to remain confidential. For this reason, images of medical photography are quite different from other photographs, and images and must be kept very carefully. Medical photographs should not be used in non-health areas [39]. The regulations include the concepts of privacy, personality rights, rights on personal records, and the need for approval. According to the results obtained from these materials, it is felt that such enterprises are subject to the permission of the patients.

Medical images are basically a document. Since it is a document, it is a basic requirement to not be able to intervene in the truth. These images should never be changed. Technically, it is partially permissible to arrange the resulting photographs without distorting the original, such as optimization. However, regulations that impair the original and can be considered manipulation are not suitable. Since any intervention in the photo manipulation programs is recorded in the metadata file, these changes can be detected in the criminal laboratories when the subject is transferred to the judiciary. Medical images taken in series should be as original as possible and should explain the truth frequently [40, 41].

The medical imaging of medical imaging involves significant ethical and legal responsibilities [42, 43]. A "medical photography and video recording consent form" is used for this convenience. In this form, the images to be taken are given in medical trainings and in scientific research. It is reported that the images are shown to the patient after taking them and after the approval of the patient they can be used. They must be stored in safe environment, necessary actions are taken to prevent the recognition of the patient against the possibility of seeing by the non-medical person. Although received images are approved, it is told that the patient has the right to give up later and that the patient will not be paid any money due to the use of these records. It is clearly stated in the form that the patient has the right to request the presence of a nurse, relative, or friend at the time of taking the medical images. Following this information, the consent of the patient or his/her parent/guardian that the images can be used in the education of health-related students and medical professionals, such as medical faculty and nursing school, in appropriate scientific journals and scientific books, and at national and international scientific meetings is taken. The form is completed by the signature of the physician who made the statement.

To comply with Health Insurance Portability and Accountability Act (HIPAA) regulations, consent should be requested from all patients before medical photographs are taken. The consent form should also include permission to publish all photographs of the patient or use them for academic purposes.

15.6 Medical Photography in Breast Surgery

Medical photography in breast surgery can be discussed in three subgroups according to the purpose of the photographs as clinical photography, intraoperative photography, specimen pho-

tography, and photography for radiological images.

15.6.1 Clinical Photography

Clinical photos, including the preoperative and postoperative photographs, can be obtained when a patient is awake and cooperative. Medical photographs play an important role in determining and evaluating the breast shape especially before the oncoplastic and reconstructive surgeries. Any accessories such as necklaces, earrings, bracelets, rings, and watches should be removed before the photography taking if possible, in order not to make a recognizable point for the patient and not to destruct the image. To achieve optimal positioning, the patient should be standing, directly facing the camera, and the camera should be positioned directly opposite the patient. It is imperative that these steps are followed during each photographic session so that a series of pictures is taken in a standardized manner [44]. For standardization viewpoint, background, lighting, magnification, and patient positioning is particularly important. Black or preferably dark blue uniform colors are better for backgrounds especially in a studio setting. Two matched lights especially at the same density at 45-degree angles to the object are the main lightning options. Object distance and lens focal length should be fixed for ratios. An anterior view, oblique at 45° of both side views, and lateral of both side views are the main breast views for best breast photography. Irrespective of a patient's condition, a set of 10 standard views should always be photographed of both breasts in sets of arms are up and at the belly (Fig. 15.1). For this setting, a special step board might be used to help the patient with her standing position directions (Fig. 15.2). These 10 views are essential to demonstrate the preoperative and postoperative appearance of the breasts.

Especially for oncoplastic surgery, the photography periods of the breast are listed in Table 15.2 [45].

15.6.2 Intraoperative Photography

Intraoperative photographs are a great resource for demonstrating a dynamic series of procedures. It is difficult and sometimes impossible for a surgeon to take consistent intraoperative photographs during a procedure, and therefore it is useful to have a dedicated photographer for each case. The camera operator must possess a basic understanding of the procedure and perti-

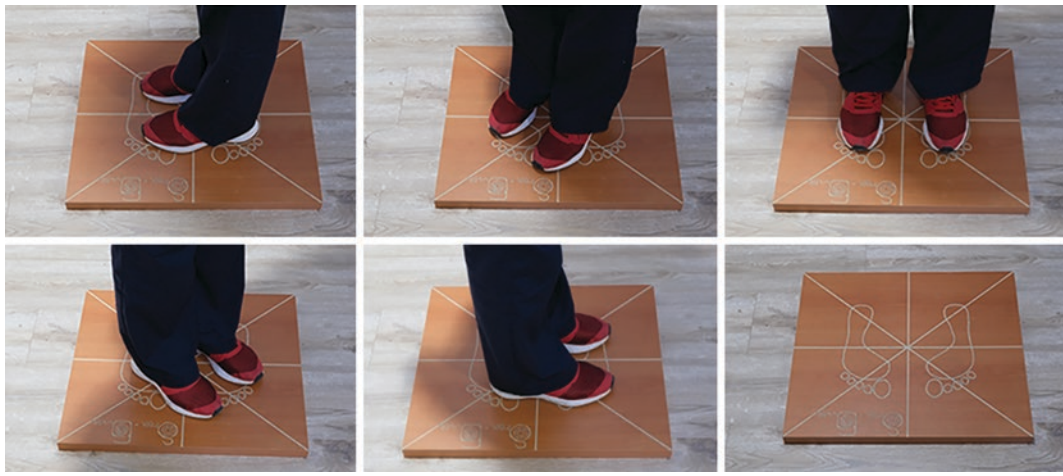

Fig. 15.2 The special step board that is used to help the patient for her standing position directions

Table 15.2 Photography periods for oncoplastic surgery

1. The baseline photography of the breast just before the surgery
2. The surgical control photography of the breast at postoperative fourth week
3. The baseline photography of the breast before the radiotherapy
4. The control of photography of the breast at first year of radiotherapy
5. The follow-up photography of the breast at first, second, and fifth years

nent anatomy to properly obtain relevant high-quality photographs. The suggested position for the camera operator is directly behind the surgeon, shooting from the surgeon's view. While taking pictures, the surgical light source should be turned off to avoid shadows caused by the camera that could affect color balance. Like clinical pictures, we prefer a green surgical towel for every procedure, removing redundant instruments and excess blood whenever possible. It is important to keep the surgeon's and assistant's hands and fingers out of the surgical field by using hooks and retractors to move an erroneous muscle, tendons, and tissue from the focus of the picture [46]. Intraoperative photographs can be taken after cleaning the entire surgical area of debris and having cleaned up any bloodstains on the patient's and surgeon's hand. The background should be a clean green (or previously recommended color) towel with the creases removed by pulling on all four corners, free of water or bloodstains. It is better to take a full view of the breast to effectively present the orientation and relationship of tissue and structures to the viewer.

If more details of the tissue are to be reflected in the photograph, another picture can be taken while moving the camera closer to the subject. In surgical pictures, the focused area should be parallel to the axis of the photograph. To demonstrate the different layers of the tissue, sufficient depth of field should also be considered [47]. Typically, in the breast surgery scenario especially for the axillary procedures, the tissue layers are close, and the distance from the plane of focus to the background (or foreground) tissue is small, necessitating a smaller aperture setting and large depth of field (Fig. 15.3). One should adjust the parameters beforehand to spare time during the procedure. When pictures are used to demonstrate the geometry of a defect, a sterile ruler will be used just to reference the amount.

15.6.3 Specimen Photography

During surgical specimen photography, a ruler will aid in providing a reference for the size of such objects (Fig. 15.4). Surgical specimens should be photographed in two separate locations, near the extraction site of the specimen and isolated in the background. Similarly, dyed sentinel lymph nodes, lumps, or other breast-conserving surgery specimens should be photographed next to the donor site and alone on the background. A sterile marking pen may be used to identify patient information, or this information can be input digitally with editing software. White balance is so important to obtain the exact color tone of the photography (Fig. 15.5).

15.6.4 Photography for Radiological Images

When digital radiographs are not available, and photographs of radiographic film need to be obtained, the photographs of radiological images may be taken. But it is extremely difficult to take high-quality photos just in front of a bright negatoscope light. To perform best quality, the room lights also must be lighted on with the negatoscope. The camera flash must be turned off, and the camera's black and white mode must be active. The exposure must be reduced to the minus setting because overexposure would reduce details of the radiological images. The camera's light sensor tends not to be as accurate on direct light sources and can lead to overexposure of the photograph. Therefore, it is important to position the camera in the best possible orientation to achieve adequate lighting throughout the whole picture.

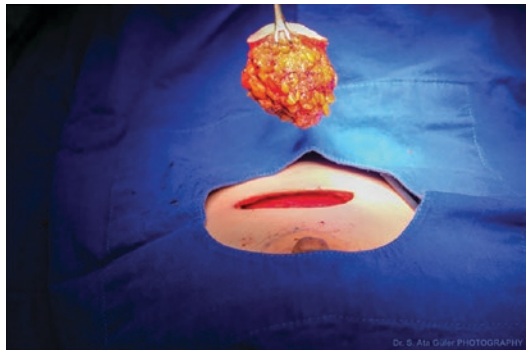

Fig. 15.3 Intraoperative photography of breast mass

Fig. 15.4 Specimen photography of mastectomy

15.7 Conclusion

High-quality photographic documentation is an integral aspect of breast surgery for the purposes of demonstrating its cosmetic shape, evaluating surgical results, and academic communication. An appropriate camera and lens are essential to producing the best photographic results. The three standard breast views should be obtained for each patient to compare natural posture, operative results, and cosmetic success. When additional views are required, the proper settings should be considered so that the best possible photograph is always obtained. Images should also be digitally formatted to provide a consistent and high-quality product.

With the introduction of digital technology into our lives, film photographic machines have been replaced by digital photographic machines that are easy to acquire and use. With the use of these machines by physicians and health professionals, the concept of a professional hospital photographer has been mixed. It requires physicians and health professionals to be knowledgeable about basic photography, features of medical subjects, and ethical concepts to produce medical photographs that are accurate, of

Fig. 15.5 White balance of a specimen photography

high quality, and ethical. In this way, much better quality, relevant, and successful medical visual documents will be obtained for use in education, archiving, judicial situations, and scientific publications.

Because of the great importance of medical photography in medicine, the main steps of taking high-quality photographs in breast cancer management must be an important issue.

Tips and Tricks

- Use a professional digital single-lens reflex (DSLR) or mirrorless camera with appropriate lenses instead of a mobile phone or tablet camera.
- Use a standard set of views in a studio setting for clinical photography.
- Obey the basic rules of operation theater for intraoperative and specimen photography.
- The light is must be the major component for taking high-quality medical photographs so control the light options of medical settings.
- Medical and ethical issues are so important, do not forget to give information about your aim in taking medical photography to the patient, and obtain a patient consent form.
- Store the photographs on a secure server with limited access or on a secure hard disk.

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