

# Clinical Photography for the Oral and Maxillofacial Surgery Practice

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## ABSTRACT

Clinical photography is an essential part of oral and maxillofacial surgery practice. To produce high quality reproducible photos, it is necessary to be familiar with principles of clinical photography. This paper provides oral and maxillofacial surgeons with an overview of principles of photography, archival storage, error avoidance and clinical applications of digital cameras for obtaining a quality image.

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## INTRODUCTION

The first evidence of medical photography has a history of approximately 150 years, when Gurdon Buck published first medical paper with preoperative pictures of a patient in 1845.<sup>1,2</sup> Digital cameras made a revolution in clinical photography by improving accessibility to image and data storage.<sup>3</sup> The specialty of craniofacial surgery is broad and deals with a diverse range of complications and clinical appearances. Uniform patient photographs are essential in today's oral and maxillofacial surgery practice. Disqualified photographs can affect the understanding of the influence of surgical procedure. Clinical photographs are important for several purposes, such as presenting the goal of surgical intervention for the patient; to evaluate surgical outcome; photodocumentation for medicolegal cases and medical records; to prepare presentations and publications and to help with the clinician's scientific development.<sup>1-3</sup> Therefore, surgeons spend a considerable time in evaluating and discussing photographs.

Although different papers have been published on this subject, oral and maxillofacial photography needs to be more reviewed. Furthermore, dental publications mainly focused in orthodontics. This paper provides oral and maxillofacial surgeons with an overview of principles of photography, archival storage, error avoidance and clinical applications of digital cameras for obtaining a quality image.

## BASIC PHOTOGRAPHIC CONCEPTS

Although there are several types of digital cameras designed for specific purposes, understanding the basic principles of

photography like concepts of lens aperture and shutter speed can help the photographer to fix any possible errors. Traditional and digital are two main generations of cameras, both of which reflect light from an object through the lens and finally produce an image on the medium. Medium in traditional cameras is called film which developed to charge-coupled device (CCD) in digital cameras (Fig. 1). The CCD in digital single-lens reflex (DSLR) cameras is equipped with an ordered mosaic of red, green and blue filters detecting different colors with distinguished wavelengths. Even though film and CCD have similar functions, CCD is more adjustable for different photography setups.<sup>1,2</sup>

ISO speed is defined as ASA number which represents film sensitivity to light. Higher ASA number results in greater sensitivity of film to the light.<sup>3</sup> For instance, ASA 400 will help the photographer to take photos in low light and without using flash. The CCD of the digital cameras can regulate several light speeds ranging from ASA100 to ASA1600 allowing photography in various conditions. ASA can be set automatically or manually in modern generations of digital cameras.<sup>2</sup>

The amount of the light traveling through the lens and reaching CCD contingents on two parameters: Shutter speed and aperture. Shutter speed is the amount of time that the shutter stays open and allows light to reach CCD. Shutter speed is inversely proportional to the quantity of light striking CCD.<sup>4</sup> For example, a shutter speed of 1/600th of a second is darker (leads to darker image) than a shutter speed of 1/70th of a second. This becomes relatively important when photographing without a flash. Another parameter that

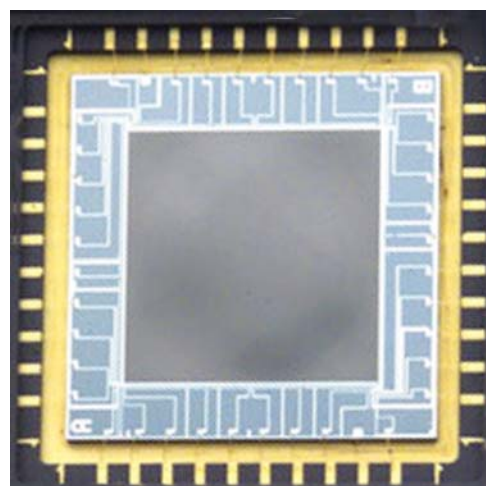
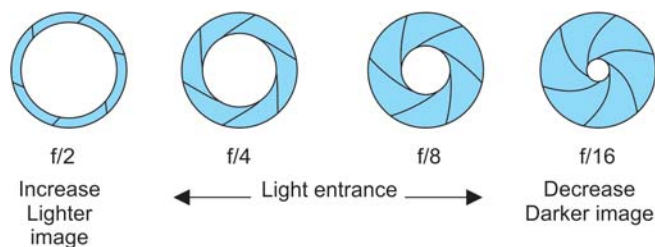


Fig. 1: CCD in digital cameras

affects the amount of light reaching CCD is aperture. Aperture is defined in fraction numbers called F-stop. F-stop is also inversely proportionate to the size of the lens opening (Fig. 2). It is of great importance to consider these basic photographic concepts when evaluating clinical photography in more details.<sup>2</sup>



**Fig. 2:** The smaller aperture results in small amount of light that enters the camera and formation of darker image

## EQUIPMENTS

The main components for taking high quality photographs are a DSLR camera, a digital memory chip card, a chip card reader and a personal computer (PC) with a monitor.<sup>5</sup> DSLR camera is combined of both digital and SLR cameras and is preferable for producing higher quality images with interchangeable lenses.<sup>5,6</sup> Dental images are more frequently taken with 35-mm DSLR cameras that are capable of taking close-up photographs.<sup>6,7</sup> Both traditional and digital cameras contain camera body, lenses and the flash system.<sup>8</sup> Function of the photo capture is correlated with camera body. A pixel or picture element is defined as the basic visible unit of digital image.<sup>8-10</sup>

It is produced via a chemical reaction when light hits the CCD. Greater number of pixels lead to a better quality of image. CCD analyzes and converts light inputs to recognizable binary code.<sup>7,8</sup>

There are important key factors to be considered when choosing lenses especially in oral and maxillofacial photography. Macrolenses are the most suitable ones for dental photography since they are able to capture an enlarged photo of a subject within a close proximity. In dental imaging, magnification and magnification ratio are main parameters for close-up images.<sup>3,8</sup> Lenses with magnification ratio setting of 1:1 to 1:10 are routinely applied in clinical photography. Lenses with magnification ratio of 1 are best for close-up pictures. These lenses are chosen for capturing maxillary incisors. The sensor size of digital cameras also plays an important role on the quality of the magnified image.<sup>2</sup> The smaller sensor size of digital cameras results in higher quality of magnified images. Teleconverters and extension tubes are two additional accessories placed

between the camera body and the lens for obtaining greater magnification (Fig. 3).<sup>4,8</sup> Images are transferred to the PC via card reader or direct connection of camera. Transferred images can be printed using a color printer.<sup>5</sup>



**Fig. 3:** Teleconverters and extension tubes are placed between the camera body and the lens for obtaining greater magnification

## PRINCIPLES OF CLINICAL PHOTOGRAPHY

Photography in clinical oral and maxillofacial surgery facilitates the classification of surgical results and helps in presentation of surgical procedure.<sup>2</sup> Unlike most other specialties, craniomaxillofacial surgery differs in that the surgeon should trace surgical outcome visually. Surgeons will discuss the results of treatment with their patients via the photographs taken before and after the surgery. They also use these images as an advertising tool for new patients. Pre- and postoperative images should be consistent with patient's clothing, the angle of camera, lighting, positioning of the patient and background.<sup>2,4,7</sup> Final images should be published in the same magnification and size compared with preoperative picture. It is crucial to place the camera at the same distance from the patient before and after the surgery.

### Lighting

Lighting and background play a key role in achieving a high quality image.<sup>5,8</sup> Background for oral and maxillofacial clinical photography should be a light blue because it contrasts to skin color and regulates shadows. Black and white backgrounds should be avoided because they result in low contrast image.<sup>5,8</sup> Installation of an electronic flash source with two soft boxes in most cameras compensates for insufficient natural light.<sup>2</sup> In order to decrease shadows on the patient, the two soft boxes should be as close to each other as possible and placed at an angle of 45°. The soft boxes should be 1 to 1.5 meters away from sides of the patient.<sup>5</sup> Main types of flash systems configurations applied

in oral and maxillofacial photography are ring flash light, twin flash light and point flash light.<sup>8</sup>

Ring flash light source system is considered to be the most common type used in oral and maxillofacial photography. It does not require so much experience. The ring flash light is placed either as individual sector flash tubes or as a single ring flash around the lens.<sup>8,11</sup> Configuration of the ring flash tubes surrounding the lens reduces shadows via mirror-type reflection and makes the image look less sharp. Twin flash light consists of two units placed either vertically in fixed positions or placed on two mobile arms farther from the lens in a circular motion and are able to emit light in every direction.<sup>8,9</sup>

Twin flash light source system needs considerable experience and knowledge. Twin flash light shows every constituent of the subject texture, color differences and transparency variations.<sup>7,8</sup> Point flash light source system has one single strobe placed on one side of the lens and can move around the lens for proper directional illumination. For instance, point flash light source should be placed at the 3, 9 and 12 o'clock for left lateral, right lateral and frontal views respectively. Point flash light source provides higher quality images by revealing texture details and contours of the subject.<sup>8</sup>

### Patient Preparation

In order to take a standard photograph, a special garb and proper patient position are recommended. Additionally, informed consent should be obtained from all patients, if pictures are used for scientific purposes.<sup>5,12</sup> Accessories such as jewels, glasses and hearing aids should be removed before photographing.<sup>13</sup> Patients are asked to tuck their hair with hair pins behind their ear for ultimate exposure of the area of interest. Heavy makeup should be avoided especially for recoding skin complications.<sup>13,14</sup> Gowns and clothing could be substituted by disposable garbs when interfering with the patient pose. Standard patient positions are required for professional quality images. The camera should place parallel to the patient face. A stool is used for facial views for proper positioning of the patients.<sup>14,16</sup> There should be also some guides and marks placed on the wall and printed on the floor to assist patients turn in the right directions.<sup>15</sup>

### INTRAORAL PICTURES

Intraoral cameras are frequently used to access oral cavity which otherwise would be hard to observe. The pen sized intraoral cameras are usually connected to a television screen for viewing pictures while photographing.<sup>5,7</sup> This is helpful for some conditions missed during visual examination. Lip retractors are used to improve the visibility of the dentition



**Fig. 4:** The retractors hold the lips out of focus for the anterior intraoral shot

and surrounding tissues.<sup>8,17</sup> The retractors hold the lips out of focus and allow maximum illumination of the oral cavity (Fig. 4).<sup>7</sup> The retractors are available as single piece self-retaining retractor or as two separate pieces. In order to increase precision, double-ended transparent retractor is preferred for a thorough vision of the oral cavity.<sup>5,7,17</sup> Although plastic cheek retractors cannot be autoclaved like metal retractors, plastic retractors are preferred for their transparency minimizing tissue coverage. Plastic retractors are sterilized using chemical agents. Pulling out the retractors both laterally and slightly toward the photographer makes it easier for the patient to bite the retractor.<sup>17</sup> Intraoral front silvered mirrors are ideal tools for areas that are out of sight and hard to be seen during clinical photography. Despite their expensive price, front silvered mirrors are more preferred for their great optical properties and resistance to scratching.<sup>5,13</sup> Mirrors with long handles keep the fingers from being too close to the scene. Mirrors should be warmed or patients should be asked to hold their breath for 10 seconds before photographing to prevent misting the mirror. Alternatively, the use of suction near the mirror or a surface tension reducer would decrease the fogging on the mirror. In order to achieve a 90° view of the area of interest, mirrors and occlusal plane should be at an angle of 45° relative to each other.<sup>5,8,17</sup>

For a detailed description of the standardized photographic sets of intraoral views the reader is referred to articles by Ettorre et al<sup>5</sup> and Schaaf et al.<sup>17</sup>

### EXTRAORAL PICTURES

Lateral, full face frontal, oblique and submental oblique views should be documented for extraoral picture set.<sup>5,17</sup> Additional complementary images can be obtained from patients with more complex features like facial palsy, skull deformities, orthognathic surgery. It is recommended to use a chair with adjustable vertical setting for the alignment of patient's focus point with the camera. It is indispensable that the camera and head should be at the same level and at fix distance before and after surgery.<sup>5,13,17</sup> Chairs with

backrest are beneficiary for constant position of the head and spine relative to the camera. The photographer should notice alignment of picture with middle axis of occlusal plane. It is noteworthy that extraoral pictures should be captured in portrait view and intraoral pictures should be taken in landscape view. Photographs should be taken at right magnification and orientation.<sup>5,13</sup> Pre- and postoperative photographs must be equal for accurate comparisons and reproduction ratios. In addition, the interpupillary plane needs to be parallel to the floor for accurate assessment. Red eye effect and shadows can be eliminated using direct light flash toward the patient.<sup>13</sup> Any distracters like handles, knobs, jewelry and other materials should be removed before photographing. It is also important to instruct patients before taking pictures. Morphology of soft tissues and skeletal pattern may be misrepresented if patients are wrongly positioned or tilted.<sup>13</sup>

For a detailed description of the standardized photographic sets of facial views the reader is referred to articles by Ettore et al<sup>5</sup> and Schaaf et al.<sup>17</sup>

### MOST COMMON MISTAKES

Technical errors usually seen in clinical photography are divided into two different categories. The first group is related to the use of equipments including lens, flash, mirrors, retractors and camera. Nonstandard position of the subject and camera is the second cause of technical errors.<sup>17,18</sup> During photodocumentation for facial plastic surgery, small changes in patient position can cause drastic difference in surgical outcomes. Inconsistent pre- and postoperative photographs lead to visual misinterpretation of facial esthetic analysis.<sup>18</sup> Incorrect camera orientation is another pitfall observed during photodocumentation.<sup>13</sup>

Immediately after taking image, the photographer should check the histogram of the digital camera to evaluate the brightness. The peak for intraoral images should be slightly to the right side of the histogram and for extraoral views should be in the middle of the histogram.<sup>17</sup> For intraoral pictures, the aperture should be set at wider mode because light is absorbed by the mirror. Teeth surface reflection is a convincing sign of sufficient light for intraoral images. Settings of the camera allow the photographer to check the focus and sharpness of the picture right after taking the image.<sup>17,18</sup> Cameras with manual sharpening are recommended in order to prevent too much automatic sharpening. Fuzzy images are not acceptable and can be avoided by manual focus.<sup>13,17</sup> The administration of anti-condensation solutions like Neo-Sabanyl before intraoral photography is helpful for eliminating mist or fog on the surface. Saliva and blood should be suctioned to prevent blood-stained appearance.<sup>13,17,18</sup>

### DATA STORAGE

Patient files should be archived and stored with maximum security. Unauthorized access to patient's file must be prevented for confidentiality. Databases should contain password-protected log-in facility for safety.<sup>5,17</sup> Informed consent is required for personal data storage. Backups are regularly required for potential data loss due to system crash. Classification of images is recommended based on patient name and diagnosis. The advantage of organized database is to facilitate data retrieval.<sup>17,19</sup> In an effort to improve photodocumentation, satisfactory picture of the session should be selected and labeled immediately after photography. Intraoral images taken with mirror need to be flipped for adjustment of the picture into its real position before storage.<sup>17,18</sup>

### CONCLUSION

It is important for the oral and maxillofacial surgeon to aware of principles of photography and all the possible mistakes in extra- and intraoral clinical photography, to enhance the chances of obtaining high quality images.

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