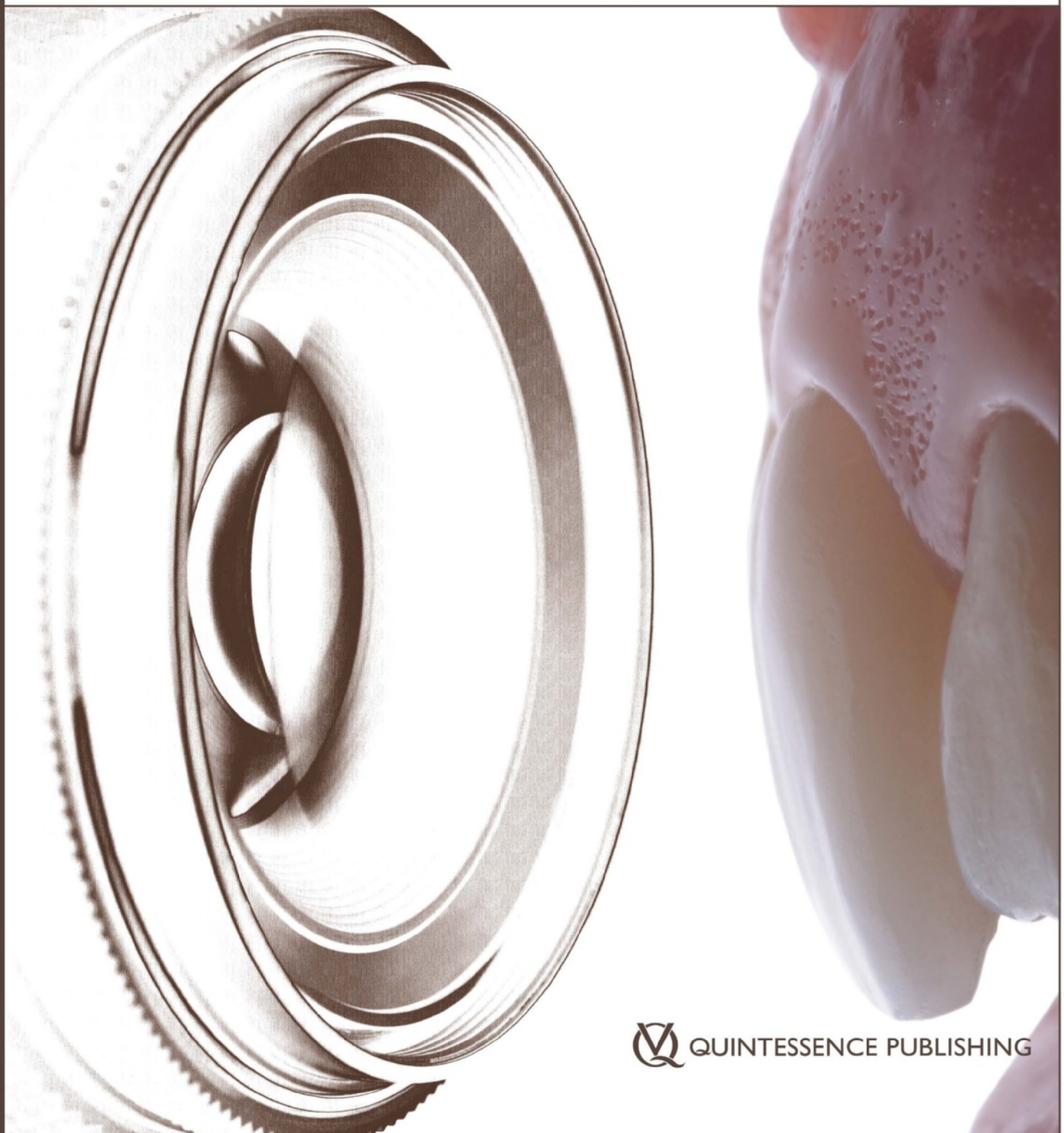
DENTAL VISUALIZATION

A PRACTICAL APPROACH TO DIGITAL PHOTOGRAPHY AND WORKFLOW

MIRELA FERARU / NITZAN BICHACHO



QUINTESSENCE PUBLISHING

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Dedicated with great love and admiration to my mother, Dr. Cornelia Feraru.
Mirela Feraru

In loving memory of my parents, Sofi and Dr. Haim Bichacho.
Nitzan Bichacho

Dr. Mirela Feraru

Mirela Feraru, D.M.D. graduated in 2005 from the Dental Faculty of the Timisoara University, Romania.

In 2009 she joined the Bichacho Clinic team in Tel Aviv, Israel. For the last 8 years Dr. Feraru has gained in-depth knowledge and experience in all fields of perio-prosthetic aesthetic dentistry, focusing on restorative and perioplastic surgery treatments.

She continues studying and participating in advanced programs and courses around the world in the various fields of modern perio-prosthetics.

Dr. Feraru has acquired extensive experience in high quality dental photographic documentation and has been sharing it with colleagues world-wide through articles, lectures and workshops.

Publishing and lecturing internationally, her focus is on restorative adhesive treatments, interdisciplinary state-of-the-art perio-prosthetic treatments and on high-end treatment-dedicated dental visualization.

Prof. Nitzan Bichacho

Nitzan Bichacho, D.M.D. holds the post of expert in prosthodontics at the rank of Professor, at the Faculty of Dental Medicine, Hebrew University and Hadassah, Jerusalem, Israel, where he graduated in 1984.

He is a Faculty Member of the Departments of Oral Rehabilitation of both dental schools at the Hebrew University in Jerusalem and at Tel Aviv University.

He is Past President and a Life Member of the European Academy of Esthetic Dentistry (EAED), Honorary Member of several associations worldwide and serves on the editorial boards of leading dental journals.

Prof. Bichacho publishes and lectures internationally in the fields of dental implant therapy, fixed prosthodontics, interdisciplinary treatments and innovative treatment modalities in esthetic dentistry.

The Bichacho Clinic in Tel Aviv, Israel, focuses on interdisciplinary treatments and collaborates with world renowned dental technicians.

FOREWORD

Dentistry is a practical profession and as such, visualizing and documenting dental treatments is fundamental to effective communication between the treating team, with professional colleagues and with the patients, in addition to the obvious high-quality documentation required for educational purposes.

This book is not about artistic photography. It is about dental visualization; dental photographs should be taken for a specific purpose, with a targeted aim in mind to be used as a clinically relevant tool, and must be an exact and accurate representation of the area or objects photographed.

Generating a high-fidelity image is essential in order to correctly assess the diagnosed clinical condition; with the proper utilization of the camera system, specific structures and features may be highlighted as required, and demonstrated in the most relevant manner.

In addition to the basic principles and techniques of photography described in this book, clear and easy-to-follow protocols and instructions are presented, enabling the reader to quickly and easily set-up the optimal setting of the camera system and auxiliaries, according to the type of clinical situation to be captured.

Included in this book are numerous photographs from the daily practice at our private clinic, together with the applied specific settings of the camera system and the environmental arrangement as used when these images were taken. This enables the reader to have a clear understanding of the elements involved, and to produce the same photographic quality of similar clinical situations, based on an understanding of basic photography rules and how to control light and shadow through the flash systems.

In this book reference has been made to specific camera and accessory brands which are used in our clinic, however, any camera system and accessories with similar qualities may be used for dental visualization, whilst adhering to the principles and concepts set-out in this book.

Practical, straightforward, comprehensive, and to the point – this book provides dental practitioners with the required knowledge and the opportunity to improve their skills, to produce high-quality dental photographs during daily practice, tailored to any type of treatment situation.

We wish you clarity, professional advancement, and enjoyment, as you add this essential skillset to your daily practice.

Mirela Feraru and Nitzan Bichacho,
Tel Aviv, 2018

ACKNOWLEDGMENTS

Our sincere gratitude goes to Dr. Carlos Ayala Paz and Dr. Christian Coachman, chapter co-authors, for contributing their time and expertise to this book.

Our special thanks to Simone Labe, our ever-patient personal assistant, for her dedication and invaluable support in formatting and editing this book.

MF and NB

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PRINCIPLES OF HIGH-QUALITY DENTAL PHOTOGRAPHY

Dentistry has evolved in the last decade and has become based on digital techniques. This evolution has made it possible to achieve a constant, predictable, and thorough assessment of each treatment, which in turn leads to more accurate diagnoses, digitally assisted treatment planning, and digital/robotic manufacturing of various restorations. One of the main tools in the armory of digital dentistry is the digital camera and its various accessories. With a digital camera, clinicians can gain a better overview of a patient's situation, gathering and assessing relevant and critical information in order to make informed decisions. The basic fundamentals of digital dental photography must be understood in order to properly handle a digital camera and to master the different protocols in order to achieve the best results.

THE IMPORTANCE OF DIGITAL DOCUMENTATION – WHY AND WHEN TO DOCUMENT

Dental photography, unlike other forms of photography, has some unique characteristics and factors that must be considered: the background of the mouth; patient-related factors such as an insufficient mouth opening; the natural wet environment; the presence of different anatomical structures; changes from intraoral to extraoral settings; and other unique factors that will be further discussed and explained. The photographer (the clinician or another member of the treating team) must always visualize the final outcome and have an understanding what needs to be recorded and communicated, prior to taking the picture in order to set up and control the camera accordingly. This book focuses on one camera system, a Nikon camera body and its related accessories, in order to explain and demonstrate the dental digital concept.

The purpose of this book is to highlight and summarize the most basic and relevant parameters of dental digital photography to provide clear guidelines to the modern-day clinician of how to master and control the different documentation processes (intra or extraoral) in a consistent way. The various setting recommendations presented relate to the setting of a Nikon camera body with a macro lens and two side flashes (Figs 1-1, 1-2, 1-3, 1-4). After mastering this set-up, more advanced photographs can be produced by adding diffusers and bouncers to the flashes, adding a third flash to the twin flashes, or by changing the lens. However, for the vast majority of clinical requirements the basic set-up provides adequate and satisfactory results, and accordingly the focus of this book is on this set-up.

One of the most popular questions among practitioners today relates to the uncertainty of the importance of daily use of a digital

1-1

1-2

1-3

1-4

1-1,1-2, 1-3, 1-4 Nikon camera with different brackets and bouncers.

camera. This uncertainty is also derived from the fact that dental documentation was/is perceived to be a time-consuming process yielding inconsistent results. Indeed, we are confronted with a challenging environment to document and different situations that require different settings of the camera. Intraoral photography and portrait images differ completely in terms of the size of the object to be photographed, the amount of light required, and so on. The inclusion of documentation activities as part of regular treatment does not mean that the time allocated to a certain procedure should be three of four times longer. If this is the case the whole process becomes unfeasible and not applicable to daily work. In this light, protocols are simplified to an extent that still allow for high-quality images.

Whenever protocols or techniques become too complex, there is a tendency to abandon them. We try to be efficient in our daily clinical work; therefore, the photographic set-up must also be user-friendly both in its technical settings and in the handling of the camera. Finally, the results must be consistent. Efficiency and consistency in obtaining high-end results are key elements. In other words, the digital camera should be a permanent tool in the clinical armory of every clinician due to the increasing importance of images in dentistry.

RELEVANCE OF COMMUNICATION BASED ON DOCUMENTATION

In order for professional growth to occur one must be able to learn and constantly improve their clinical work. Employing documentation in treatment enables communication via images and becomes an active tool in daily practice. This communication tool is reflected in our relationship with the patient by offering the possibility of explaining to them treatment plans and showing preliminary changes to be performed, and this information can also be shared with colleagues, and last but not least, with the dental technician.

In the past, the roles of the patient, clinician, and dental technician would operate as individual entities, however in today's world of modern dental esthetic treatment, these three separate roles are integrated resulting in constant interaction and active roles of each member. Increasingly, dental technicians are involved right from the start of a case and are aware of the proposed treatment planned for the patient.

1-5 A Preoperative view of the smile.

1-6 A Smile of the patient after mock-up.

1-5 B Preoperative view with retracted lip of the anterior maxillary teeth.

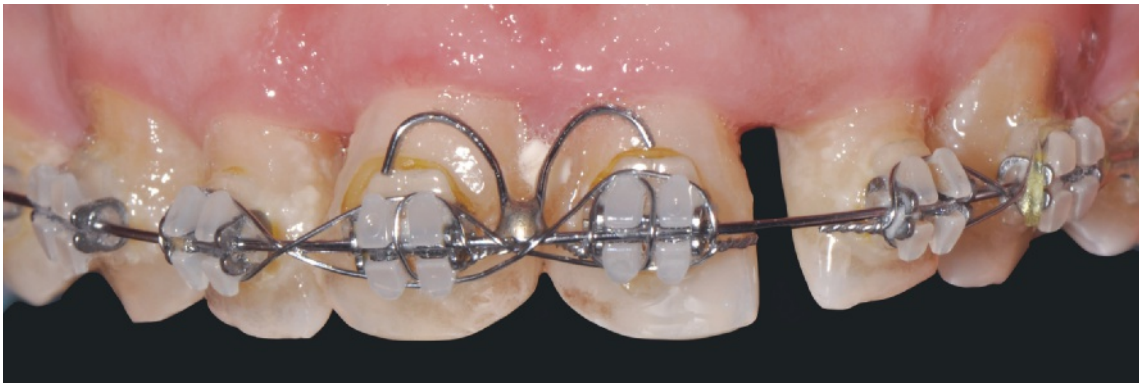
1-6 B Intraoral view of the mock-up with the lips retracted.

COMMUNICATION WITH THE PATIENT

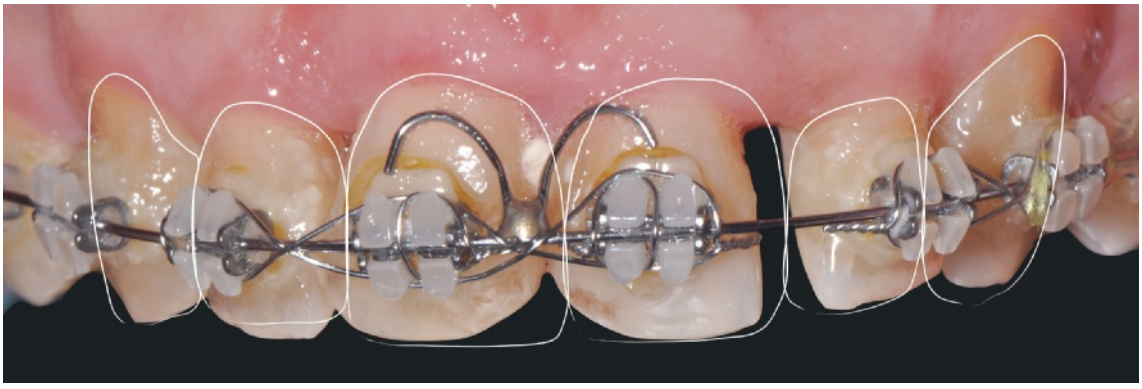
One of the most simple and efficient methods to explain and deliver information to patients is via visual communication. The way we approach our patient plays an important part in their overall treatment acceptance. From the start, clinical pictures should explain the main concerns, so awareness of the main problems is created. A better understanding of the intended changes is obtained by analyzing and comparing the images taken with the preoperative view and after the intraoral simulation of the changes planned (eg, with and without the intraoral mock-up, Figs 1-5 A and B and 1-6 A and B). The visual language becomes common between the clinician and the patient, allowing for an increased awareness of their situation and their compliance toward the treatment increases. At the same time, from this stage the patients can already "connect" to the final desired esthetic appearance and once this happens, the different treatment steps are more easily accepted.

INTERDISCIPLINARY PLANNING

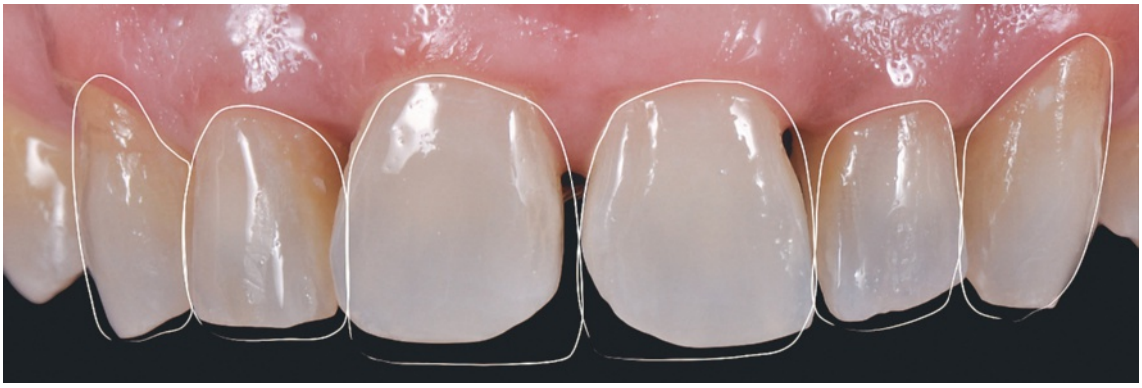
In the majority of challenging treatment plans that generally involve an interdisciplinary approach, the use of intra and extraoral images become an indispensable tool for correct diagnosis, planning, and decision-making. Together with the help of different software (eg, Skype, PowerPoint, Keynote, and so on) the communication between different specialists is immediate, direct, and efficient (Figs 1-7, 1-8, and 1-9).



1-7 Clinical image of finalization of the orthodontic treatment before the restorative phase.

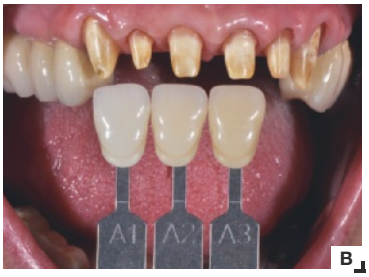


1-8 Use of the clinical image in order to explain to the orthodontist the desired position of the teeth before the restorative phase for minimal tooth structure removal.



1-9 Final result after the orthodontic correction with the optimal position of the teeth in the arch before the restorative phase.

1-10 A Color registration of adjacent teeth.

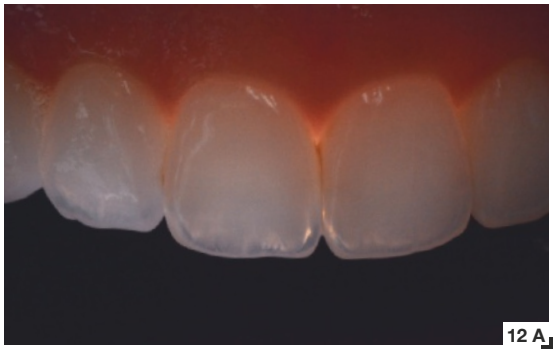


1-10 B Color registration of prepared abutments.

1-10 C Color registration of the soft tissues for pink ceramic/composite.

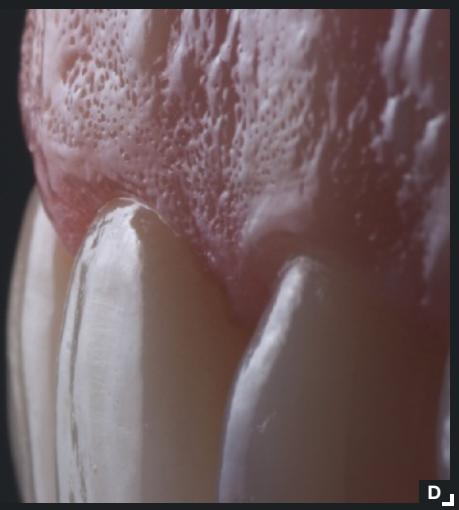
COMMUNICATION WITH THE DENTAL TECHNICIAN

Photographic communication with the dental technician is not limited to the obvious transfer of the color information (Figs 1-10 A to C). The technician also needs to be informed of all the possible information regarding the surrounding tissues, the shape and size of the patient's natural dentition, and the form of the patient's face, especially when dramatic changes are planned. "Just a picture" is not sufficient if the intention is to achieve high-quality results. Detailed registration of different internal characteristics of the teeth (Figs 1-11, 1-12 A and B), surface texture (Fig. 1-13 A to C), and soft tissue contours (Fig. 1-14 A to D) is best performed by digital registration. Wax-up models of all teeth (Fig. 1-15 A) should always have, as a starting point, an accurate impression together with a clear and high-quality image of the preoperative situation (intraoral and face photography). These can prove invaluable (Fig.1-15 B to H).

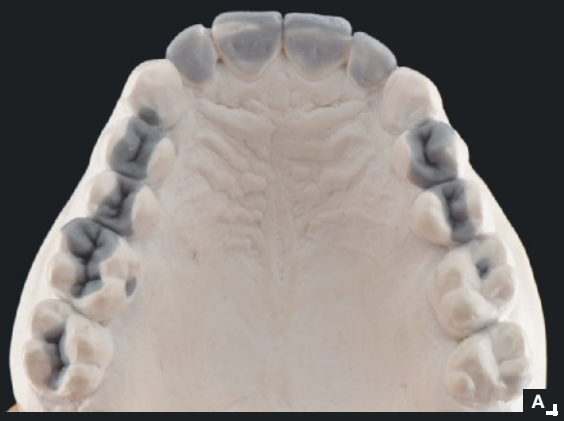


1-11, 1-12 A, B Clinical images of anterior maxillary teeth that emphasize their optical characteristics under different lightening.

1-13 A to C Clinical images that depict the surface characteristic of natural dentition.



1-14 A to D Clinical images that depict the soft tissues surrounding prepared teeth and ceramic restoration.

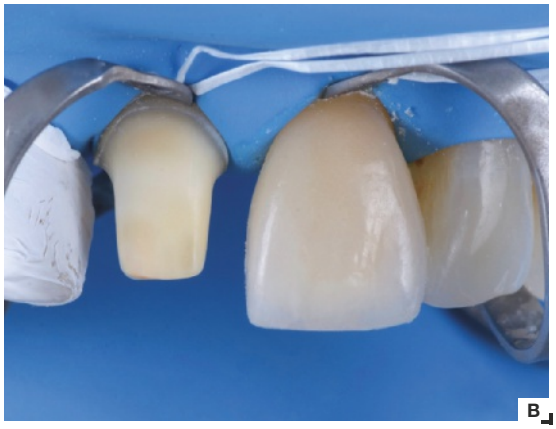


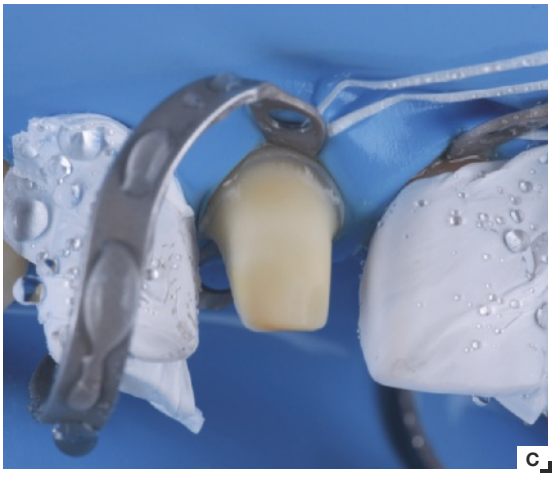
1-15 A Image of wax-up of upper arch.

1-15 B to H Basic set of images to be sent to the dental technician when complex diagnostic wax-ups are to be requested which involves full face and intraoral images.

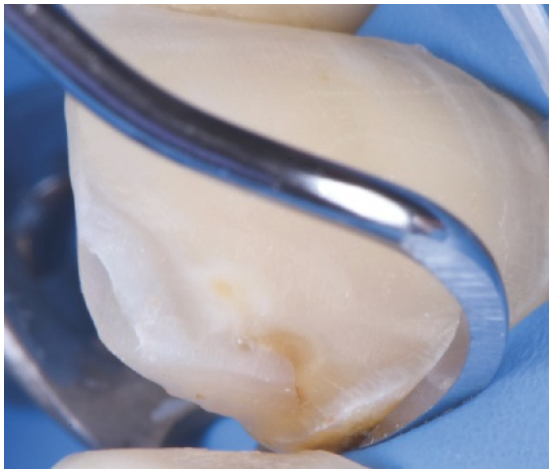
SELF-ASSESSMENT TOOL

In order to improve the clinician's skills and to assess the quality and effectiveness of any treatment, constant documentation of the different steps is mandatory (Figs 1-16 A to C). An in-depth investigation of an enlarged image will reveal minute details (Fig 1-17) that are often missed during a real-time procedure. Studying these details is not only essential for further self-improvement, but also for planning necessary improvements to be implemented in due course.





1-16 A to C Different steps during a restorative treatment (bonding step) which enables the dentist to assess the quality of the treatments performed for continuous self-improvement.



1-17 Intraoperative image depicting calculus during the bonding phase.

03

SIMPLIFIED CLINICAL PROTOCOLS FOR HIGH-END RESULTS

In this chapter, three main protocols for dental documentation will be detailed and the necessary armamentarium to achieve high-quality images will be described: portrait, intraoral, and extraoral photography (laboratory work). For each protocol, the complete settings of the camera will be presented and the accessories required will be described.

Efficiency is one of the most import requirements in our daily practice, because time is a crucial factor in our work. For a digital camera and documentation to play an integral part in daily procedures, its set-up protocol should be as simple as possible with only a minimum of changes of parameters between different clinical situations. As discussed above, the entire session of the clinical protocols refers to the use of a Nikon D7200 camera with a 105 mm macro lens (or 100 mm Tokina macro lens), wireless macro flashes SB-R200 with an R2 dual point flash bracket or R1 dual point flash bracket (www.photomed.com) (Figs 3-1 A and B).

Each clinical protocol will cover:

- general considerations
- photography sequence
- settings of the camera
- required accessories

A

3-1 A Nikon D7200 with R2 dual point flash bracket.

B

3-1 B Nikon D7200 with R1 bracket.

As mentioned previously, there are several parameters that are important to be correctly adjusted for specific clinical situations in dental photography. These are: ISO, aperture, shutter speed, white balance, and flash power. Some of these parameters (white balance and shutter speed) once set, will remain the same for majority of the clinical protocols. Clinical documentation can be divided into two main categories:

1. Preoperative session (gathering information regarding the case for an in-depth analysis and treatment planning) that includes full-face photography and a series of intraoral/perioral images.

2. Intraoperative images – documentation during different treatment steps.

PREOPERATIVE SESSION

Any treatment that involves the esthetic area should have, as a starting point, a full sequence of photographic documentation (full face/portrait and intraoral/perioral) that would provide in-depth information regarding the preoperative situation. A better analysis of the main concerns is achieved during the treatment planning by having all the necessary information available (clinical images, radiographs, study models, and so on). A basic sequence of images is the minimal requirement for any preoperative documentation. With this as a starting point, several different images can be added according to the clinical situation and main type of treatment to be performed,

3-2 Nikon D7100 R2 twin flashes with bouncers.

which includes prosthetics, orthodontics, or periodontal treatment. More complex and complete protocols according to these specialties will be addressed separately.

FULL-FACE PORTRAIT PHOTOGRAPHY

The following refers to a normal dental office setting. At the end of this chapter, attention will be given also to the option of studio photography and the materials and accessories used.

CAMERA SETTINGS

A Nikon D7100 with 105 mm macro lens, two side flashes and bouncers attached will be used (Fig. 3-2).

In dental photography, the only situation in which we work with automatic focus is with portraits. The settings of the camera will have the following guidelines (Fig. 3-3):

» F values around 10–13
» Shutter speed 1/125
» ISO 400
» Flash power 1/1

ISO 400	S 1/125	F 10–13
	flash power 1/1	

3-3 Camera settings for portrait images.

The shutter speed values remain constant for all of the protocols together with white balance.

There are two elements for portrait photography that need to be noted. One is a controlled background, in which attention is focused on the subject and other distracting objects in the frame are avoided. The second element is controlled lighting. With lights on stands or hanging from the ceiling, it is possible to choose the angle at which light strikes the subject. In many situations, limited space in the room will reduce the options of having complex equipment for portrait photography.

CHARACTERISTICS OF THE LIGHTING

A ring flash is not suitable for portraits because of the flat appearance of faces, a lack of a three-dimensional image, and a shallow depth of field.

Additional flashes might be necessary for cases in which the background needs to be lit separately (white background). To avoid shadows, especially in the neck area, the use of a reflector held by the patient is recommended.

Standardization is required in general in all dental photography. In portrait images, it is recommended to maintain the same distance from the object, or utilize a tripod.

3-4 A Portrait image with white background.

3-4 B Portrait image with black background.

BACKGROUNDS

A black or white background is most commonly used (Figs 3-4 A, B). These backgrounds should emphasize the profile characteristics of the patient's face and therefore should not have any design or reflective qualities. Additional flashes might be needed whenever a white background is used and placed behind the patient in order to compensate for the inevitable shadows that form in the back. It is very useful to have (in cases when space permits) a special corner dedicated to taking portraits and videos.

According to the complexity of the case, the photographic session can be divided into a basic (limited number of pictures) sequence and a more extended one. It is up to the practitioner to decide the type of session required.

STUDIO PORTRAIT PHOTOGRAPHY

For studio photography, light diffusers such as a beauty dish (Figs 3-5 A, B) or soft boxes (Figs 3-6 A, B) are used. The bigger the size of these diffusers, the softer the light will become, and a more three-dimensional image will be obtained. Of course, this will

A

3-5 A Beauty dish without a diffuser.

B

3-5 B Beauty dish with a white diffuser.

A

B

3-6 A, B Different types and sizes of soft boxes.

3-7 Example of a studio photography room.

necessitate a bigger space for a complete set-up (Fig. 3-7). The type of light source used with the light diffusers (beauty dish or soft boxes) are speedlights (Figs 3-8 A, B). A speedlight (referred to as a "flash gun") is a portable flash that can be fired on the hot shoe of the camera, or fired wirelessly. The real advantage of a speedlight is that it can be less expensive, and more portable. The disadvantage of using speedlights is that they are not as powerful as a studio strobe. A studio strobe can generally release at least double the light compared to a speedlight. Speedlights have a slow recycle time, which means that one often has to wait between 1.5 and 5 seconds between pops of the flash when the flash is turned up to full power.

A

Strobes can be also an option (Fig 3-8 C). A studio strobe is a larger light that is powered with AC power. They have to be either plugged into the wall, or connected to a large battery pack to power them. Studio strobes have lightening-fast recycle times, so the photographer ***never*** has to wait for the flash to catch up. Their disadvantages are that they are less "comfortable" than a speedlight, because they are not easy to carry around and also are quite expensive.

B

C

3-8 A, B Different speedlights.

3-8 C Studio Strobe.

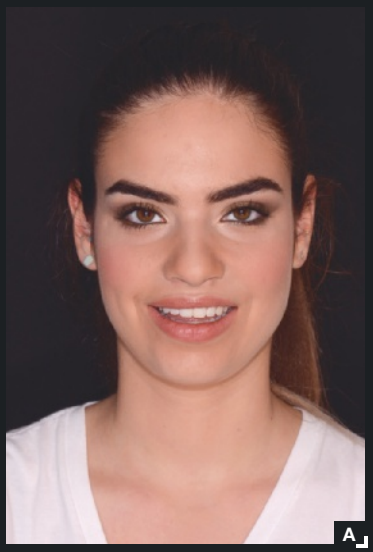
3-9 A Frontal view portrait image with white background.

3-9 B, C Right and left semi-profile views with white background.

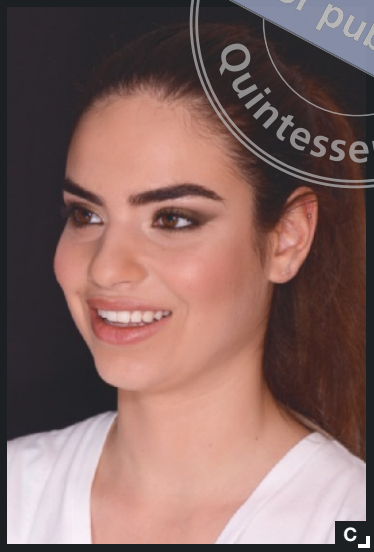
3-10 A Nikon D7200 with 100 mm Tokina macro lens and R1 twin flashes system and bouncers.

3-10 B Nikon D7100 with 105 mm Nikon and SB-R200 dual twin flashes with bouncers.

WHITE BACKGROUND WITH EXTRA SOURCE OF LIGHT A) CAMERA WITH BOUNCERS		
Set-up	***Gear guide***	***Camera settings***
» Camera held in a vertical position and the bouncers are directed toward the ceiling and toward the patient » One source of light to illuminate the background	» Two SB R200 Nikon macro flashes with R1 or R2 dual point flash bracket (Figs 3-10 A, B) » Two bouncers » One light (additional flash) to illuminate the white background » Reflector – silver or gold	» F 10–13 » ISO 400 » Flash power 1/1 full power » Additional flash, 1/4 or 1/8, depending on the distance (Figs 3-9 A to C)



3-11 A Frontal view portrait image with black background.

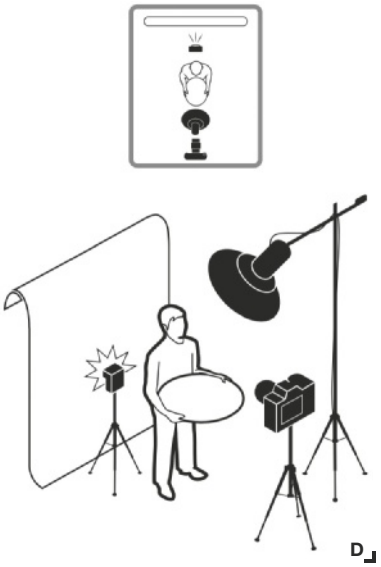


3-11 B, C Right and left semi-profile views with black background.

BLACK BACKGROUND A) CAMERA WITH BOUNCERS		
Set-up	***Gear guide***	***Camera settings***
» Camera held in a vertical position and the bouncers are directed toward the ceiling and toward the patient	» Two SB R200 Nikkon macro flashes with R1 or R2 dual point flash bracket (Figs 3-10 A, B) » Two bouncers » Reflector	» F 10–13 » ISO 400 » Flash power 1/1 (Figs 3-11 A to C)

3-12 A Beauty dish frontal view with white background.

3-12 B, C Beauty dish right and left semi-profile views with white background.

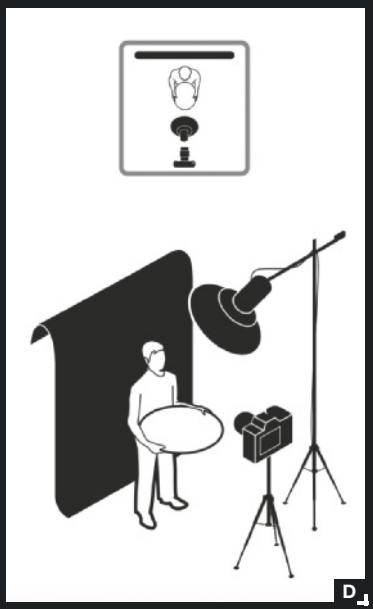


3-12 D Schematic drawing of the set-up for portrait photography with beauty dish on white background.

STUDIO PHOTOGRAPHY – PORTRAIT B) BEAUTY DISH » WHITE BACKGROUND		
Set-up	***Gear guide***	***Camera settings***
» A beauty dish as a light modifier will be used together with a speedlight » Direction will be in front of the patient » A reflector will be used in order to eliminate the shadows around the neck area » For the white background, an additional source of light will be needed (which can be either a flash (speedlight) oriented toward a white wall or one soft box behind the patient. See Fig. 3-16 drawing for the soft box behind the patient)	» Beauty dish with speedlight » Reflector » Additional source of light to illuminate the background (additional speedlight)	» F 10–13 » ISO 400 » Flash power » Beauty dish (1/4) » Additional light for the background, 1/4 or 1/8, depending on the distance between the light and the patient (Figs 3-12 A to D)

3-13 A Beauty dish frontal view with black background.

3-13 B, C Beauty dish right and left semi-profile views with black background.

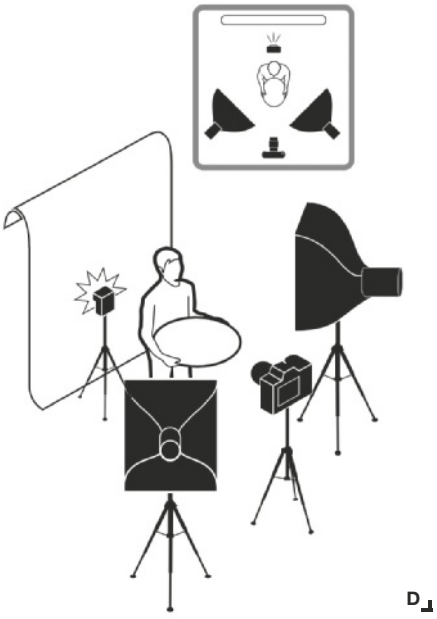


3-13 D Schematic drawing of the set-up for portrait photography with beauty dish on black background.

STUDIO PHOTOGRAPHY – PORTRAIT B) BEAUTY DISH » BLACK BACKGROUND		
Set-up	***Gear guide***	***Camera settings***
» A beauty dish as a light modifier will be used together with a speedlight » Direction will be in front of the patient » A reflector will be used in order to eliminate the shadows around the neck area » No need for additional light	» Beauty dish with speedlight » Reflector » No need for additional light	» F 10–13 » ISO 400 » Flash power » Beauty dish (1/4)

3-14 A Soft boxes: frontal view image with white background.

3-14 B, C Soft boxes: right and left semi-profile views with white background.

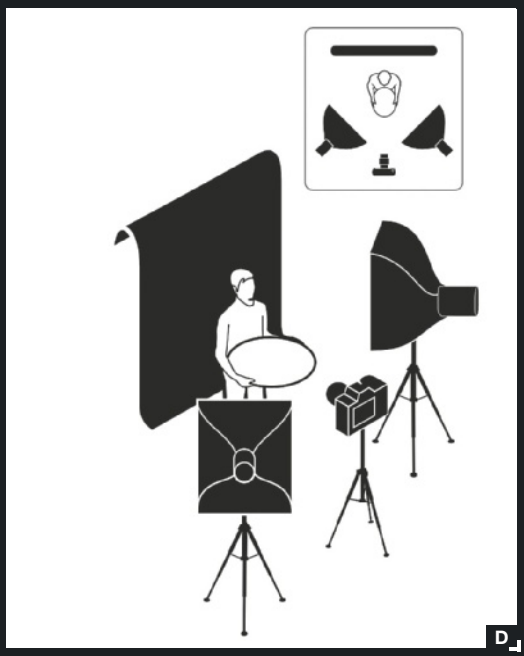


3-14 D Set-up of soft boxes with white background.

STUDIO PHOTOGRAPHY – PORTRAIT C) SOFT BOXES » WHITE BACKGROUND		
Set-up	***Gear guide***	***Camera settings***
» Two soft boxes are placed, each one oriented 45 degrees toward the patient » Reflector is used » For the white background, an additional source of light will be needed (which can be either a flash (speedlight) oriented toward a white wall or one soft box behind the patient)	» Two soft boxes » Reflector » Additional source of light to illuminate the background (additional speedlight)	» F 10–13 » ISO 400 » Flash power » Soft boxes (1/4 or 1/8) » Additional light, 1/4 or 1/8, depending on the distance (Figs 3-14 A to D)

3-15 A Soft boxes: frontal view image with black background.

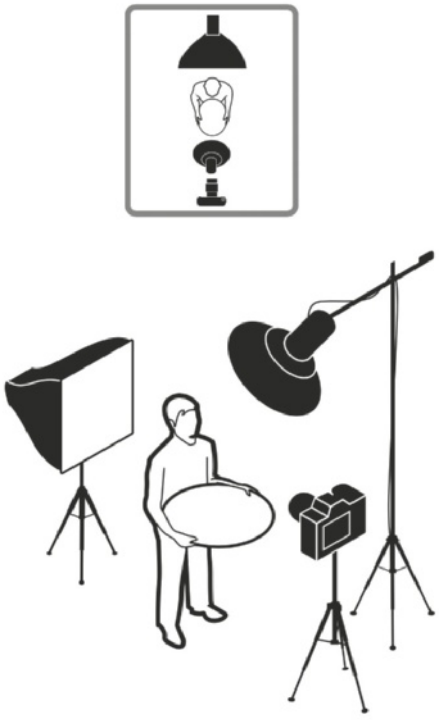
3-15 B, C Soft boxes: right and left semi-profile views with black background.



3-15 D Set-up of soft boxes with black background.

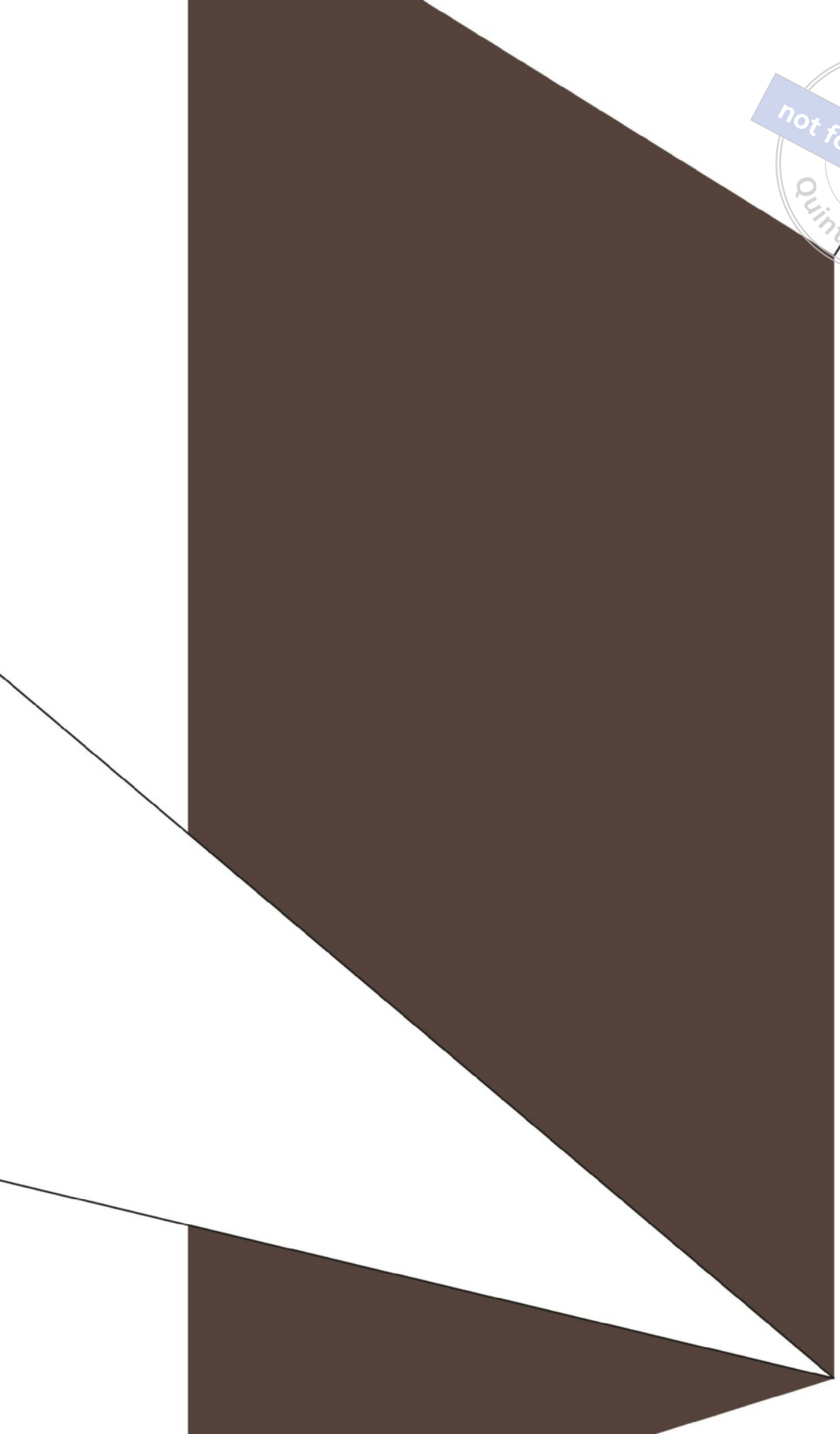
STUDIO PHOTOGRAPHY – PORTRAIT C) SOFT BOXES » BLACK BACKGROUND		
Set-up	***Gear guide***	***Camera settings***
» Two soft boxes are placed, each one oriented 45 degrees toward the patient » Reflector is used » No need for additional light	» Two soft boxes » No need for additional light » Reflector	» F 10–13 » ISO 400 » Flash power » Soft boxes (1/4 or 1/8)

According to the conditions in the office in terms of space, one can choose from these three ways of taking portrait images. Figures 3-16 show the schematic arrangement of the set-up for portrait photography with the light modifier used. For all portrait photography, to trigger several flashes we will need remote controllers (wi-fi or infrared; see Fig. 3-17). The transmitter will be attached on the flash hot shoe of the camera and can control several receivers that will be connected to the speedlights.



3-16 Set-up of beauty dish with soft box as the additional light source for the white background.

3-17 Phottix transmitter and receiver for studio photography.



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