Clinical Pearl

An Orthodontist's guide to clinical photography.

[1]Kolge NE, [2]Karandikar GR, [3]Patni VJ, [4]Ravindranath VK, [5]Karandikar AG, [6]Shinde P

[1]Post Graduate Student, Department of Orthodontics, MGM Dental College & Hospital, Navi Mumbai.

[2]Professor & Head, Department of Orthodontics, Bharati Vidyapeeth Dental College & Hospital, Navi Mumbai.

[3]Professor, Department of Orthodontics, MGM Dental College & Hospital, Navi Mumbai.

[4]Professor & Head, Department of Orthodontics, MGM Dental College & Hospital, Navi Mumbai.

[5]Professor & Head, Department of Orthodontics, Saraswati Dhanwantari Dental College & Hospital, Parbhani

[6]Associate Professor, Department of Orthodontics, Bharati Vidyapeeth Dental College & Hospital, Navi Mumbai.

To cite: Kolge NE, Karandikar GR, Patni VJ, Ravindranath VK, Karandikar AG, Shinde P

An Orthodontist's guide to clinical photography

J Contemp Orthod 2019;3(3): 64-70.

Received on: 22-07-2019

Accepted on: 25-08-2019

Source of Support: Nil

Conflict of Interest: None

INTRODUCTION

An Orthodontist's Guide to Clinical Photography Authors' Details Dr. Neeraj Eknath Kolge[1] Introduction Basic Orthodontic records include Study Casts, Radiographs and Clinical Photographs. Photography has become an invaluable medium for patient documentation over the past many years.

With the dawn of digital photography[1, 2], it has become an easy and economical task to produce highest quality records of every clinical situation as and when required. Further, with aids for data transfer and softwares, photographs are easily accessible, transferable and can be shared with anyone around the globe. Emphasis is now on appropriate guidelines for capturing intra-oral & extra-oral photographs and radiographs in a suitably standardized manner.

This article attempts to deal with essentials like the camera controls, equipment and accessories required for clinical photography, procedure for acquiring the right photographs, common errors and editing guidelines. 'Hot Tips' too are suggested to allow the best possible results to be consistently achieved.

Need for Clinical Photographs : To compare pre and post-treatment clinical records , To aid in communication with patients/parents, To use as a teaching/motivational tool, To maximize learning experience for students and colleagues, To make publications /research more meaningful To meet/satisfy medico -legal requirements Exposure Triangle Aperture , Shutter Speed and ISO are three vital factors (Fig.1)

that will determine the quality of the photograph and are vital to develop a complete understanding of the basics of photography. Aperture: In the simplest form, aperture is best described as a 'hole' in the lens through which the light enters the camera. The aperture size influences two important factors namely: Amount of Light Large aperture = Smaller f-number = More light Small aperture = Larger f-number = Less light Depth of Field (DoF) DoF is that section of photograph that is in proper, sharp focus. Large DoF means that most of your image will be in focus.

Small DoF means that only part of the image will be in focus and the rest will be fuzzy . Large aperture = Smaller f- number = Shallow (small) DoF Small aperture = Larger f- number = Deeper (large) DoF Hot Tip #1: The lower your f- number , the smaller your DoF . Likewise , the higher your f- number , the larger your DoF. For example, using a setting of f/2.8

will produce a very shallow DoF while f/11 will produce a deeper DoF. Maximum DoF value for most cameras is f/32. Shutter Speed: Shutter allows the light entering the lens to fall on the camera's sensor (which replaces the physical film in an analog camera). Shutter speed is a measure of quantitative assessment which determines the time for which camera sensor is exposed to external light.

There are high chances that photos may get blurred while using a slow shutter speed (1/30 or below) due to inadvertent movement of the camera. It is always advisable to use a tripod or some form of image stabilization modality when you are shooting at a slow shutter speed for capturing minute natural colour variations shot in ambient low light (sunset/sunrise).

Hot Tip #2: If the shutter speed is fast, less light will fall on the sensor, thus producing a darker image and vice-versa. ISO Controls: ISO Control is a measure of qualitative assessment which determines the sensitivity of the image sensor. It ranges from 100, 200, 400, 800 and goes up to 2,56,000 in professional level DSLRs which do not have applicability in routine dental photography.

The lower the number the less sensitive your camera is to light and the finer the grain. ISO 100 is generally accepted as 'normal' and will give acceptable shots (little noise/grain). Hot Tip #3: With a particular camera setting, if the acquired image is noticed to be dark, further images can be made acceptably brighter by merely increasing the ISO; decreasing the Shutter Speed; increasing the Aperture (decreasing the f-number) or a combination of the above.

Hot Tip #4: With a particular camera setting, if the acquired image is noticed to be bright, further images can be made acceptably better (darker) by either of the following methods: decreasing the ISO; increasing the Shutter Speed; decreasing the Aperture (increasing the f-number) or, a combination of the above. Photographic Equipment For ease of description, this is categorized into essential and supplementary (Fig. 2).

Camera Compact Digital Cameras: Compact cameras are the simplest ones often used for non-dental purposes and are often referred to as 'point and shoot' cameras. They are small in size, economical and with fewer features; thus reducing the 'quality' of photographs. They have low power 'in-built' flashes; offer the 'default' auto focus mode but, may not offer manual focus mode and a relatively limited optical zoom capacity.

Photographs can generally be saved in a pre-specified format, usually JPEG only. Digital Single Lens Reflex (SLR) Cameras: One of the 'higher end' cameras, they give a better quality of image obtained. The photographer can choose the lens needed for the situation and this can be easily interchangeable, if need be.

Hot Tip #5: Many national/international journals/publication houses, especially professional ones pertaining to the field of Orthodontics/Dentistry expect photographs to be submitted in RAW format as it is non-editable and therefore represents the true skill of acquiring a particular image in an unaltered form. Bridge Cameras: Though they resemble SLR in many ways, they operate much slower than the latter.

They are bigger in size, have a fixed lens (that cannot be detached from the body and thus be swapped with another one); have a high optical zoom capacity and option of switching to manual focus. Images can be stored in multiple file formats: JPEG, RAW or both simultaneously. Bridge camera combine some virtues of both point and shoot and DSLR cameras.

They are acceptable for extra-oral photographs, but have their own limitations in acquiring intra-oral photographs. Mobile Phone Cameras: It is the 'Lazy person's via media'. Mobile phone cameras, often from a practice management perspective are considered inferior by family/parents. Common fear for patients and parents alike with their use includes the purported nefarious intent that can make a captured image go viral even in a second! This type of photography is beyond the scope of this present article.

Hot Tip #6: Though, megapixels (MP) are a measure of quantity and not quality, they are important when it comes to printing images. It is a known fact that print media needs higher megapixel. But, how high, is the pragmatic question. 'Megapixel Math' has been very well explained [3] (Table 1). If you tend to crop your photos , look for a camera (or camera setting) with about 50 percent to 75 percent more megapixels than recommended. Sr. No.

_Dimensions of print (in inches) _Minimum Megapixels _Table 1: The 'Megapixel Math' Macro Lens: This special lens is designed for photographing subjects at very close distances as well, which normal lenses (18-55 mm, or its equivalent) do not permit. Despite coming to within a few inches of the object, a macro lens permits the object to be in sharp focus. These lenses have many variations.

A macro lens which reproduces an unmagnified depiction of the object has greatest applicability in Dental/Orthodontic photography. Hot Tip #7: '1:1 Macro Lens' has the ability to focus from infinity to 1:1 magnification. This means that the size of the image in real life is the same size as it is recorded on the sensor by the camera. All types of macro lens need not have a 1:1 capability.

A 1:1 Macro lens, from different manufacturers, may be available in slight variations of their focal lengths: 90 mm (Tamron SP 90 mm f/2.8 Macro), 100 mm (Canon EF 100 mm f/2.8 Macro USM), 105 mm (Nikon 105 mm AF-S VR 105 f/2.8G, Sigma 105 mm f/2.8) etc. Teleconverters: Especially the macro focusing variety, or, Telephoto Extenders may be used as a substitute for macro lens.

Flash: Is used primarily to avoid shadows and illuminate the subject in a predictably uniform manner. Various types of flashes are available: a 'built-in' flash (that comes with the camera), Ring Flash, Ring Light, Twin Flash and mobile phone attachments (if applicable). The most versatile ring flash is one which offers the option of being used to in quarters/ halves/in

full. Ring Light does not offer this feature.

It has in two variants in the type of light used: Incandescent and White. Accessories Accessories required for high quality clinical photographs are as follows: Mirror: Mirrors are used for indirect visualization when the area of interest is not directly visible to the camera. Special care is taken to preserve the delicate surface coating of mirrors by cleaning and storing them using microfiber towels.

Mirrors are available as Occlusal (Adult & Pedo size) and Buccal variety. Traditional glass or plastic-type mirrors are not recommended; those that are surface coated with chromium or rhodium provide far better reflectance and also minimize distortion4, 5 (Fig. 3) and hence are preferred.

Retractors: Their main function is to retract the labial, buccal mucosa and lips so that area of interest is exposed and well lit, thus improving visibility for effective focussing and acquiring the image. Though available in metal variety, most commonly available are the plastic ones. Metal ones have the advantage of being 100% autoclavable while plastic ones need chemical sterilization.

According to the mode of action, they can be classified as: Cheek retractors: They can be single/double ended (Fig. 4, . Double ended retractors have two different sizes thus can be adapted in range of mouth sizes. Lip retractors: It is used to retract lips during occlusal photographs for proper visualization (Fig. 4) of incisal edges and labial/buccal surface.

Defogging the mirror: Fogging is a common problem which usually occurs due to temperature difference between the oral and room temperature. A gentle stream of compressed air and high volume aspirator can be used onto the mirror to avoid fogging and thus ensuring proper quality of photographs to be obtained. Hot Tip #8: Use of wet/lubricated retractors, warm mirrors, use of compressed air (air syringe) on the mirror surface just prior to obtaining a picture, use of high volume aspirator , proper retraction (Fig. 5) and indirect visualization technique in which camera will be at 90 0 to the mirror (Fig.6) may be vital for all intra-oral photographs . Assistant should be trained for the same. Diffusers : They are used to reduce harsh light provided by flash photography and thus avoid a burnt out effect in certain areas. Contrasters : Help removing distracting elements from the photographs which takes attention away from the frame ; can be used to depict pre /post treatment changes in the maxillary anterior regions/smile arcs, etc. They are best used to compare pre and post treatment changes of dentition/smile arc etc. It is always emphasized that “it’s not the camera, it’s the eye of the photographer” and is true for clinical photography too, as we require not just the right equipment but a skilled and knowledgeable operator to use both.

Once appropriately adjusted, almost all the DSLR cameras when used with their recommended lens and flash, produce high quality intra-oral and extra-oral images. Colour reproduction may vary, but that can be easily altered during post-processing. Hot Tip #9: In the authors’ opinion, an entry level DSLR body with a 1:1 Macro lens, use of ring flash/light, rhodium-coated mirrors and proper retractors is sufficient for acceptably high quality intra-oral photographs.

Photographic Errors Clinical Photographs Clinical photographs include both intra-oral and extra-oral photographs; thus the errors therein (Fig.7) can be segregated as follows . Intra-oral Photographs Common errors with intra-oral photographs comprise of the following : Frontal /Lateral view Hot Tip #10: High Depth of Field (>f/25) for frontal view photographs is mandatory, so as to capture complete details in the frame (Fig. 8).

Hot Tip #11: Unless the reflective ability of the mirror is excellent, light reflected by it won’t be as good as a photo taken without the mirror. As a general principle, aperture compensation by +1 or +2 for mirror image photographs can compensate for lack of reflective ability of a mirror. Hot Tip #12: Manual focus for all intra-oral photographs is preferred since autofocus mode can be unpredictable due to the short focusing distance and lack of illumination while recording the photographs. Hot Tip #13: Always use mirror for occlusal photographs.

When mirror is not used, a proper perspective of details (molar rotations, caries, etc.,) that we wish to capture, examine and depict is not obtained optimally. For mandibular occlusal views, patient is best asked to posture the tongue behind the occlusal mirror. Extra-oral Photographs Common errors with extra-oral photographs comprise of the following: Profile view Hot Tip #14: For purpose of superimposition in cephalometric softwares, often , a true lateral image (Fig . 13) is required though , according to the oft -quoted principles of photography [6,7] eyelash of the opposite side should be visible (Fig. 14) in the profile view. Hot Tip #15: All frontal /profile views should be recorded with FH plane/interpupillary line parallel to the floor by asking the patient to look straight at eye- level and camera focused on lower eyelid (automatic mode).

Hot Tip #16: Shadows can be completely eliminated or

minimized by use of natural light, macro ring flash or dummy flash/reflector. If none of the options above seem feasible, learn to take the shadow to a place where you can minimize its effect on the photograph (Fig 17) Hot Tip #17: For three quarter view, considering the total depth of the face, point below the eyebrow should be considered the centre of the photograph.

Outer sclera of the opposite eye should be visible. Photographs There is no universal number for photographs to be taken but based on many opinions[6, 7], a comprehensive set should include nine photographs: five intra-oral and four extra-oral photographs.

Intra-oral Photographs include Frontal view in maximum intercuspation, Right and Left Buccal views in maximum intercuspation, Maxillary and Mandibular Occlusal views. Extra-oral Photographs include Frontal (Relaxed and Smiling), Profile view (Relaxed) and Three Quarters view (Relaxed). In addition to the above list of nine photographs as recommended, it is the authors' opinion to supplement the following: An intra-oral frontal view with teeth slightly out of occlusion (Fig20 H). This serves following purposes: Assessing the severity of the lower anterior malocclusion . Evaluating Curve of Spee.

Judging Occlusal Canting. Two extra-oral photographs which include Three Quarter view (Smiling) (Fig. 20D), Profile view (Smiling) (Fig. 20F) and Submental view (Fig. 20M) making a total of 13 photographs . Focus & Framing We are fortunate enough that a clinical photograph involves a subject that is within the field of control of the photographer.

Light conditions can also be adjusted by the operator as and when required. Hence, these advantages of time and light can be put to good use and proper clinical photographs can be obtained. Intra-oral Photographs Manual (non-automatic) focusing is the recommended modality for all intra-oral photographs as autofocused photos may not always be reliable.

Frontal view Operator should focus on the distal half of maxillary lateral incisor or the mesial half of maxillary canine . A sufficiently small aperture should be used [high f- number (>f /22)] to ensure that area from labial surface of maxillary centrals to buccal surface of the second molars are in sharp focus. Occlusal view Operator should focus on occlusal surface of premolars.

Occlusal mirror is placed at 45 degrees to the arch and camera is aimed at 45 degrees to the mirror . Buccal view Operator should focus on the buccal surface of canines and premolars . Depth of field is not an issue for buccal/occlusal view (Fig. 21). Once this technique has been perfected, taking intra-oral photographs should not need more than a minute.

Table Top Photographs Though, X-ray viewer is gold standard, a computer screen kept open on a blank white power point presentation can be effectively used for the same. An easy way to achieve uniform illumination is by placing a radiograph on a blank white flat screen computer/monitor and then clicking a photograph without a flash preferably in a dark room.

To optimise the quality of the radiograph, it is always advisable to convert any photographed radiographs to greyscale so that the resultant black and white image is far better than one with the 'tungsten glow' (Fig. 22). Hot Tip #18: To make the cephalometric tracings clearly visible, a blank white paper should be placed between the X-ray and the tracing sheet/paper for clear and much better visualization (Fig. 23). Editing Next task after acquiring photographs is to transfer them on a computer.

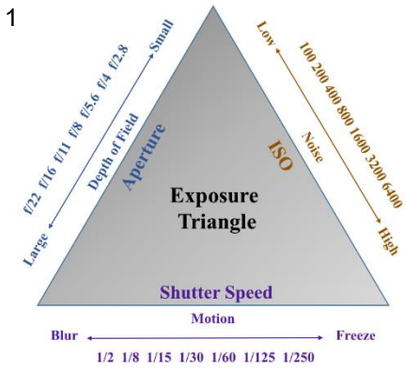
This can be done by directly inserting the memory card into the computer or using a card reader. Newer models of DSLRs provide a Wi-Fi transfer option which directly lets you transfer images from the camera onto the computer/mobile phone. Next step is to edit the photographs and save them.

Editing can be done by easy-to-use softwares like Adobe Lightroom/Google Picasa for Windows users or iPhoto for Mac users. An important thing to do and practice is to keep a backup of the data. This can be done by saving it on an external hard drive or writing it on a CD/ DVD (Fig. 24). Storage To ensure quick and easy access and retrieval of images when needed, filing your processed patients' images should be done in a clear systematic way (Fig. 25)

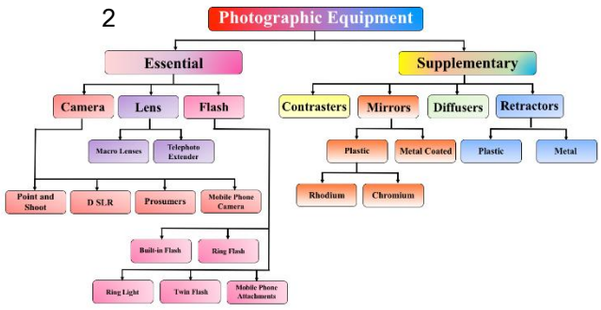
Conclusion

The authors have tried to concise basic principles of clinical photography with appropriate visual prompts. It is hoped that this publication will offer a ready-to-use thumb guide for obtaining consistently high quality photographs.

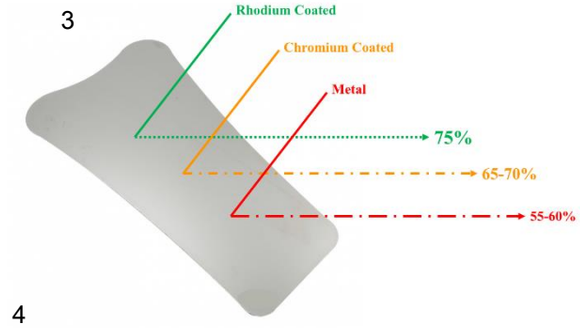
1



2

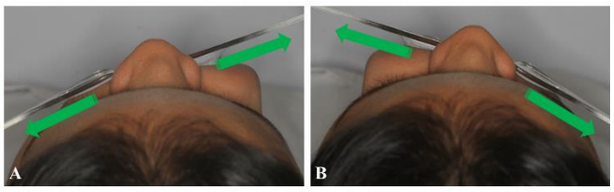


3

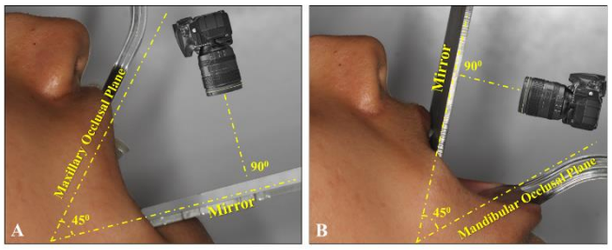


4

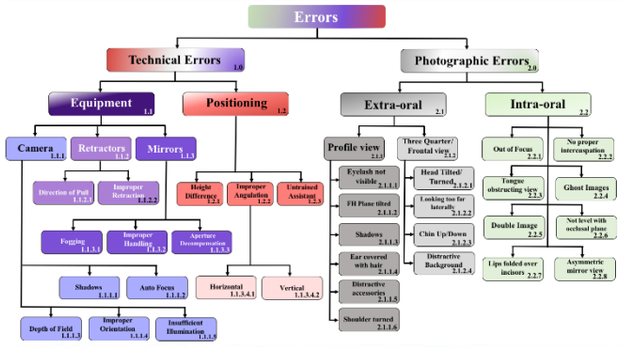
5



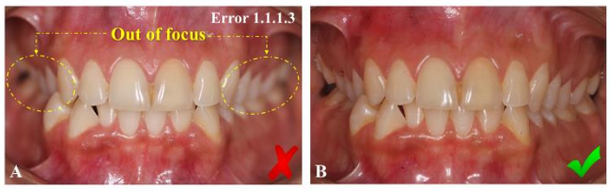
6



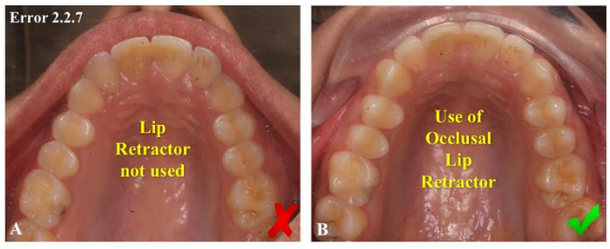
7



8

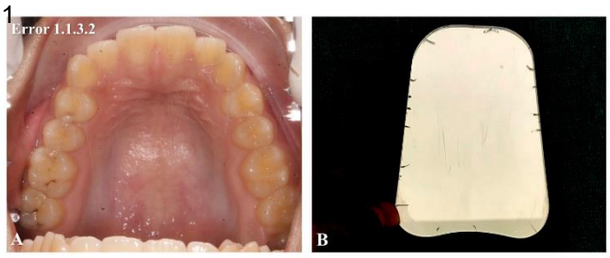


9

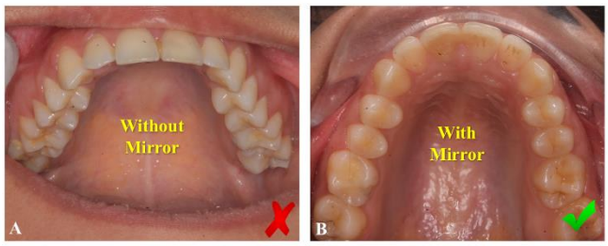


10

11



12



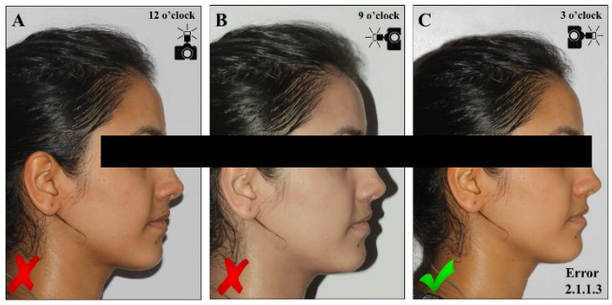
13

14

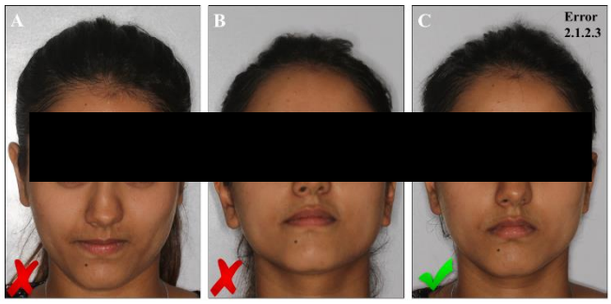
15

16

17

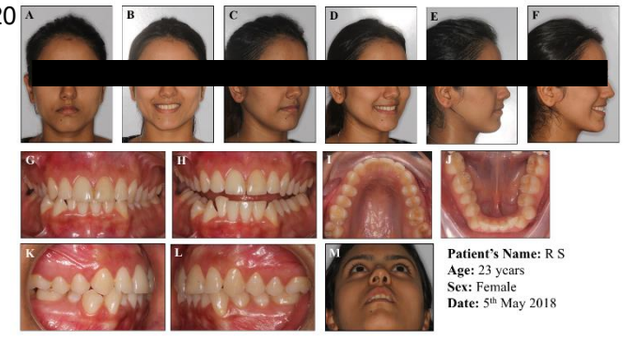


18

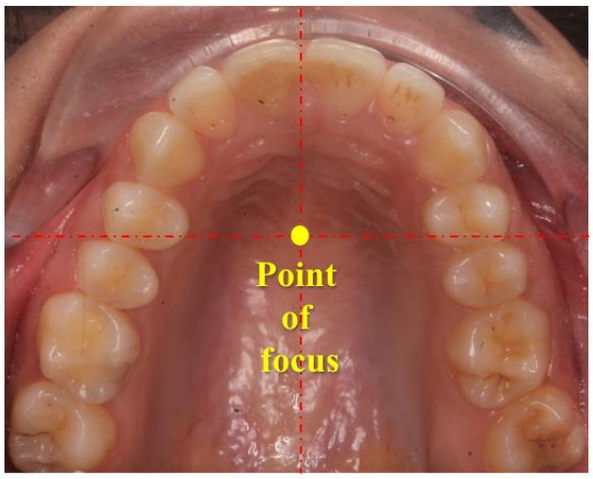


19

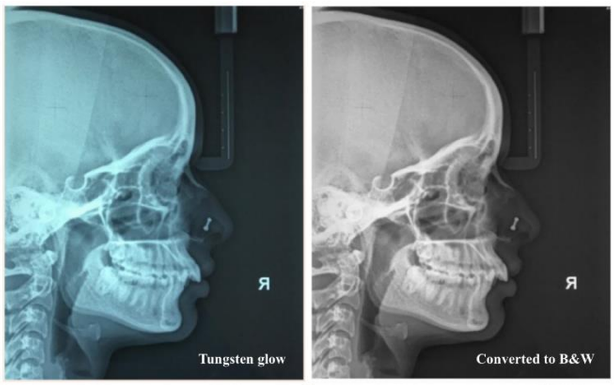
20



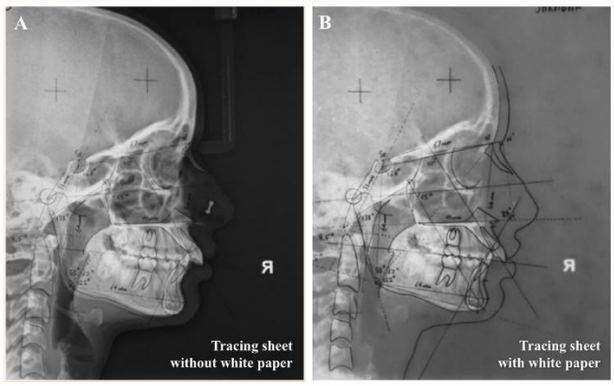
21



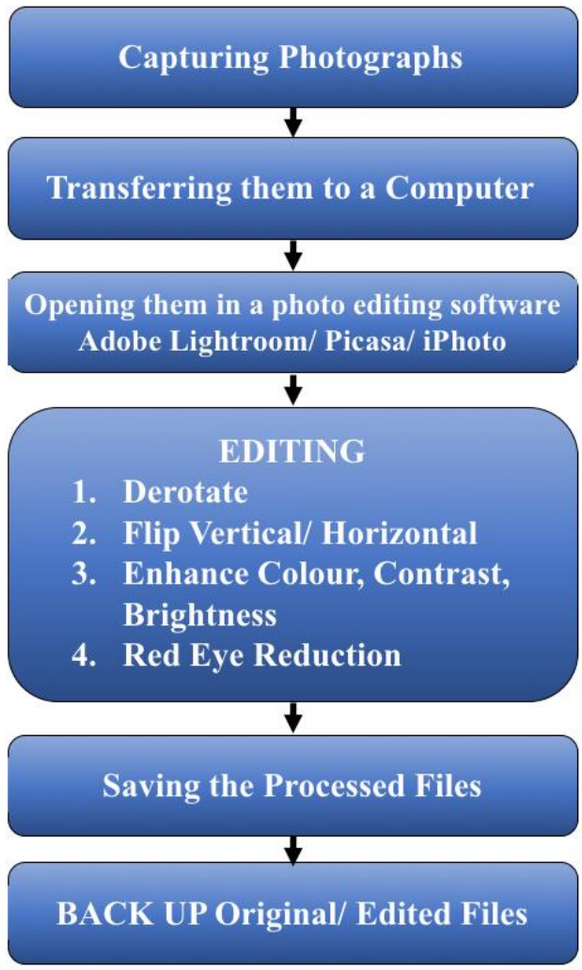
22



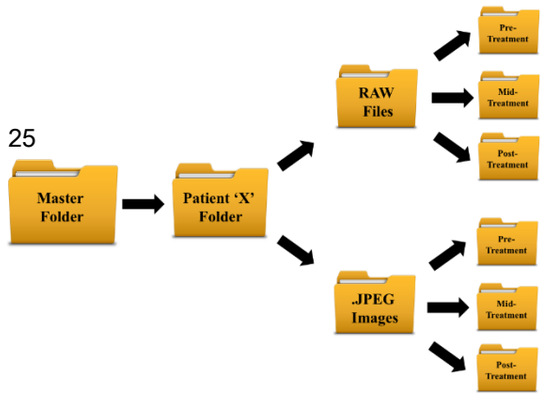
23



24



25



References

1.Claman L, Patton D, Rashid R. Standardized portrait photography for dental patients. Am J Orthod Dentofac Orthop . 1990 ; 98(3): 197-205.
2.Sandler J, Murray A. Digital Photography in Orthodontics. Journal of Orthodontics. 2001; 28: 197–201.
3.Grotta SW. How many megapixels do you really need? 2017. https://www.tomsguide.com/us/how-many-megapixels-you- need,review-1974.html.
4.McKeown HF, Murray AM, Sandler PJ How to avoid common errors in clinical photography. J Orthod 2005; 32: 43–54.
5.Sreevatsan R, Philip K, Peter E, Singh K, Gahlot MS. Digital Photography in General and Clinical Dentistry: Technical Aspects and Accessories. Int Den J St Res. 2015; 3(1): 17-24.
6.Samawi SS. A Short Guide to Clinical Digital Photography in Orthodontics. 2nd Ed. 2011. ABO. Guidelines for Photographs and Radiographs