DIGITAL IMAGING FOR AN EFFICIENT ORTHODONTIC PRACTICE

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ABSTRACT

In orthodontics the benefits of digital photography are certainly numerous. These include rapid image production, easy and quick deletion of poor images, no need for film, decreased costs for enlargement, ease of editing and image storage, effortless placement in presentations and publications. The quality of the image will be reflected in the number of dpi the camera can capture as well as the quality of optics used. The term computerized photography actually describes the blending of video and digital photography along with the processing of those images. The importance of photographs for clinical records cannot be over emphasized. Whatever the case digital imaging enhances orthodontist’s communication with patients and professional colleagues while improving clinical results.

Key words: Digital Imaging, Orthodontic practice, Computerized Photography.

INTRODUCTION

In the field of orthodontics, all the problems that relate to the equipment and techniques of intraoral and extraoral photography must be anticipated, understood and controlled by the orthodontist. However, the average practitioner finds himself in the position of requiring this understanding of a discipline in which he is largely uninformed. It is small wonder that he generally is buried under an avalanche of technical jargon, expensive equipment and conflicting opinion.

Mounted study models, facial and intraoral photographs, cephalometric evaluation of dentoskeletal relationships, computerized imaging, and clinical soft tissue evaluation are essential in proper diagnosis, treatment planning, execution of treatment, and assessment of post treatment results.

The benefits of digital photography are certainly numerous and include rapid image production, easy and quick deletion of poor images, no need for film or its associated expenses, decreased costs for enlargements, ease of editing and image storage, effortless placement in presentations or publications.

Digital images are the raw materials for presentations in the information age. The easiest way to acquire these images is with a digital camera and direct PC input. Several contributors have reviewed this topic. Digital images can also be acquired with film or flatbed scanners. This is often the only alternative to upgrade 35mm slide presentations to digital media. Ableson’s digital update describes technology advances in this area.

With so many new devices appearing on the scene almost daily, it is not possible to suggest which specific computer, camera or scanner would be the best for a particular purpose. With this in mind, this article will instead attempt to provide an understanding of the factors involved in selecting equipment and essential photographs required for orthodontic records.

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Effective use of the system

The memory (RAM) capacity of your computer is tapped when working with digitized radiographs and photographs. It is important to manage your memory resources effectively.

- The first step is to clean out "Temp" files regularly.
- If your photo-processing program uses a "scratch disk" learn how to control it and set it to use a disk with lots of space (at least 100 megabytes).
- Clear your clipboard often.
- If possible, add more RAM to your machine.

When scanning your original photographs, set your scanner software to acquire at least 300 dpi image file at the dimensions you need for your end use. Resolution is a very common term that causes considerable confusion, therefore all you need to know is that your output image resolution should be 300 dpi to make a photo-quality image.

File storage types are another source of confusion. Selecting the correct file type is critical because once saved in one file type, a file that is subsequently converted to another file type will contain less information than the original. The most common file types in use are TIFF, JPEG, Bitmap, PC or MAC. TIFF will provide maximum quality but a somewhat larger file size, while JPEG is the preferred format for transmitting email images over the internet and for web pages.

The best print quality is a result of a number of variables. Other than the printer you use, paper choice has the greatest affect on print quality. Generally, glossy paper will tend to produce the sharpest results.

Selecting a digital camera

The choice of a camera is not really difficult if guidelines are set up and adhered to. We want to obtain accurate reproduction of the head, and of the teeth and adjacent tissues. We want to use equipment that is rapid, relatively foolproof, subjecting the patient to a minimum of inconvenience, capable of a range of magnifications and preferably inexpensive. Cameras that offer single lens viewing and/or preview screens are highly desirable.

In selecting a digital camera beware of the difference between optical zooms and digital zooms. Optical zooms change the size of the selected image without reducing the total number of pixels in the final image. The amount of zoom is indicated by "x". As an example, 2x indicates double magnification of the image that is captured by camera's lens. No image quality is lost with optical zoom. But as the optical zoom increase, the focus distance from the image also increase. In this case, an additional close-up lens may be needed. A digital zoom is a pixel waster. Enlarging the image with a digital zoom electronically enlarges only the center portion of the image. The balance of the image is ignored just as if you had captured the entire image and thrown the outer portions of the image away by deleting them on the computer. Digital zooms will produce a coarser image.

The quality of the image will be reflected in the number of dpi the camera can capture as well as the quality of the optics used. The higher the resolution of the images captured, the fewer the number of images that can be stored on the media supplied. In general, it is a good idea to shoot the highest quality image your camera can produce. The reason is simple. Capturing your image at the highest resolution possible preserves your options for the future uses of the image. You can always reduce the resolution, but once the image is of low resolution, you cannot regain the lost digital information. Therefore, it is to your advantage to capture your images at the highest possible resolution and to store them as such for future use.

Computerized photography

The term "computerized photography" actually describes the blending of video and digital photography, along with the processing of those images. Advances in computer technology, along with the development of image-processing software, have put immense power on the desks and in the hands of today's orthodontists. In addition, word-processing, spreadsheets, and data-base programs have become as easy to use as cookbooks.

Traditional vs. Digital Photography

Compared to traditional photography, digital photography has the following benefits:
1. Immediacy of viewing.
2. Infrequent need for retakes.
3. No film and processing expenses.
4. Inexpensive storage.
5. Efficient retrieval by computer.
6. Inexpensive and immediate duplication, with no degradation of quality.
7. Ability to transmit by modem.

Disadvantages of digital photography include:

1. Diminished image quality (but improving very rapidly).
2. Expensive hardware.
3. Constantly improving hardware.
4. Difficulty of finding technical assistance (this will improve).

Nowadays, the computer market offers a huge number of different products, and for beginners to the art of computation, setting up and understanding an imaging system can be a hard task. This article provides some personal suggestions and information intended to make this task a little easier. Web addresses for some products are listed in Table 1.

**Essential photographs required for orthodontic records**

Photographs are an essential part of clinical records for the following reasons:

- Unreliable memories: Within a matter of months, patients and their parents tend to forget how severe the original malocclusion was. Having photographs available at every visit reminds both the orthodontist and the patient of the original situation, against which all improvement can be judged.
- Diagnosis and treatment plan: Extraoral and intraoral photographs help an orthodontist to diagnose the malocclusion and make a treatment plan by using some softwares such as quickceph and dolphin or just by hand tracing.
- Medicolegal requirements: In our increasingly litigious society, it is critical to have clinical photographs that indicate any pre-existing pathology or trauma to the teeth. Close up photographs are strongly advised for any marked decalcification or enamel fractures that are evident from the outset. The debonding appointment is often the first time patients or parents really focus in on the labial enamel, and it may be the first time they actually notice surface decalcification, fractures, or other blemishes. Proper records will help avoid any post treatment disputes.
- Teaching needs: Photographs are probably the most important teaching aids in orthodontics. If cases are to be used in lectures, posters, papers, and presentations, a high standard of clinical photography is required.
- Treatment evaluation: A quick scan of sequential slides with patients and their parents during treatment will save lengthy explanations of biomechanics or tooth movements.

**Photographic requirements**

A camera should be reliable and simple, particularly in offices where there will be many users. Minimal adjustment should be required when changing from intraoral to extraoral shots.

Cheek retractors are available in many shapes and sizes, but self holding wire or plastic retractors do not permit high quality intraoral photography. The best retractors are the double ended kind, which come in two sizes. These allow patients of all sizes to be photographed, maximizing soft tissue retraction and

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minimizing the amount of retractor shown in the photo. (Fig 1)

The best occlusal mirror currently available is the double ended type supplied by Henry Schien. The smaller end, although occasionally necessary for small children, usually functions as a handle for the photographer, allowing the tuning of the view immediately before shooting. Subtle changes in mirror position and angulation make all the difference between a mediocre and a high-quality mirror shot. (Fig 1)

**Standard orthodontic views**

For a complete photographic record, the recommended views are:

**Initial**
- Five extraoral: full face and full face while smiling, left profile (right profile only in cases of facial asymmetry), three-quarter profile and three-quarter smile (Hollywood smile). (Fig 2)
- Five Intraoral (in occlusion): Left and right buccal segments, anterior view, and mirror images of both dental arches. (Fig 3)
- Close-ups of any areas of concern: fractured, cracked, or crazed teeth, nonvital teeth, or area of hypoplasia or hypermineralization.

**Progress (during treatment or between phases of treatment)**
- Extraoral: same as above if changes have occurred.
- Intraoral: Same as above.
- Close-ups of any unusual or noteworthy mechanics or problem areas. Removable appliances used during treatment are often photographed in cases to be presented.

**End of treatment**
- Same as initial. Photographs of the retainers can also be useful.

**Functional occlusion (selected cases)**
- Three intraoral (no mirror): right and left lateral excursion, and anterior protrusion. These will demonstrate the presence of desirable guidance and absence of undesirable contacts.

Photographs should definitely precede impressions, since alginate invariably remains on the lips and cheeks and between the teeth. If possible, they should also precede radiographs, so that any abnormal tooth postures, as in panoramic radiographs, will not be repeated for the photos. For the extraoral photographs, a colored background (blue, gray, green) in contrast with face should be used in order to expose the details of face. Take extraoral before intraoral photographs, because the patient's lips will be pulled and stretched during the intraoral photography.

**Common errors in clinical photography**

While taking photograph the most common errors are:

**Extraoral Shots**

1. Misrepresentation of skeletal pattern: This can occur if the patient tilts the head too far back or forward. Try to get every patient into horizontal Frankfort plane or "natural head position". (Fig 4)
2. Inconsistent magnification between stages of treatment.
3. Red eye effect: This can be reduced by proper light adjustments. In the new cameras red eye reduction buttons are present.
4. Fish face effect: Photo taken from too close causes a fish face effect. An extraoral photo should be taken from a distance not less than 3 feet, to minimize this effect. (Fig 5a & 5b)
5. Shadows: Incorrect placement of flashlights, cause unpleasant shadows on the face and the background. (Fig 6). The best way to prevent shadows is to use a ring flash. Very small sized compact cameras can also decrease the amount of shadows, since their flashlights are very close to their lens.

**Intraoral Shots**

1. Lack of symmetry: The occlusal plane should be horizontal and bisecting the frame, and the
clinically correct midline should be right in the center of the slide.

2. Teeth out of focus: To minimize this error every intraoral photo should be taken from a distance not less than 20cm from the mouth.

4. Backdrop of oral mucosa not provided: This can be corrected if the correct retractors are selected.

6. Any residual food or saliva appearing on the photograph. You can not show this photograph to anyone. Can you?
5. Foreshortening: If the patient does not open wide enough for the mirror shots, foreshortening and arch distortion will occur. The occlusal mirror should be rested against the most distal tooth in the arch being photographed, then placed on the opposing incisor tips. When ready to take the photograph, ask the patient to "open twice as wide".

6. Misrepresentation of the sagittal discrepancy: When first taking orthodontic photographs, many clinicians believe that sufficient retraction for buccal view will inflict undue pain on patients. Proper selection of retractors helps a great deal, as does asking the patient to turn as far as possible to left or right against the pressure of the retractor. Still, it is essential to include the distal surface of the first molar, with the shot taken perpendicular to the posterior segments if possible.

CONCLUSION

The rate of change of digital imaging technology is truly impressive. If you are reading this article even a short time after its original publication date, you may already be a generation behind. Exciting new technology is being introduced daily. Even full time medical photographers have difficulty achieving high quality orthodontic photographs. Remember, it is just as easy to take good pictures as bad ones. Whatever the case, digital imaging enhances orthodontist’s communication with patients and professional colleagues while improving clinical results.

REFERENCES