ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 10, Issue, 09, pp.73897-73902, September, 2018

DOI: https://doi.org/10.24941/ijcr.32445.09.2018

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

DIGITAL PHOTOGRAPHY IN DENTISTRY

[1]Mona Palandurkar and [2,]*Dr. Akhilesh Shewale

[1]Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India
[2] Department of Periodontology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India

ARTICLE INFO

Article History:
Received 10th June, 2018
Received in revised form
17th July, 2018
Accepted 20th August, 2018
Published online 30th September, 2018

Key Words:

Photography,
Mobile Dental Photography,
Dentistry, Dental Ethics.

ABSTRACT

Images are fundamental in day to day practice of dentistry. They serve as documentation of dental procedures and as forensic evidence and they play as an essential role in dentist patient communication providing the basis for patients expectation and treatment. The present article provides the brief inside on the same.

***Citation: Mona Palandurkar and Dr. Akhilesh Shewale*, 2018.** "Digital Photography in Dentistry", *International Journal of Current Research*, 10, (09), 73897-73902.

INTRODUCTION

Photography has become an integral part of daily life. The days of film are just about gone and the desire for instant photography review is almost present everywhere. It is widespread and is present in every sphere of human activity right from research to entertainment and from documentation to creating stunning pictorial work of art. It has always been considered an invaluable part of dentistry. It plays a vital role not in academics but also in clinical practise. With the advancement in digital technology, imaging has become easier and more readily accessible. It serves as documentation and forensic evidence. It plays an essential role in dentist and patient communication and gaining confidence. It acts as a way of expressing idea.

History: In the nineteenth century, Joseph Nicephore Niepce one of the "father of photography" was the first who became interested in the technique of lithography (The Fathers of Photography). Though his experiments with lithography were not succeeded but it gave him a new idea that lead him to begin experimenting with photograph. "Another father of photography" Louis-Jcques-Mande Daguerre a Frenchman, was the first to publically present the first camera of the world in Paris in 1839.

***Corresponding author:* Dr. Akhilesh Shewale,**
Department of Periodontology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, India

Photography at that time was an elite affair but his amazing achievement in photographic field made photography, a much easier and more accessible task. British scientist and inventory William Henry Fox Talbot invented the very first process for creating photographic images in 1934 and here veiled it in public in 1939 and he was also known as "father of photography." The year 1839 was the year when both photography and dentistry were born. The first practical process of photography was presented to the world and the first dental journal was printed in this year. A few years later, both professions has change our way of life worldwide. The first dental journal stimulated in such a way that the world's first dental school, Baltimore College of Dental Surgery, and the first dental society were organized. The world's first photographic gallery opened and was operated by a dentist-turned-photographer Alexander Wolcott also known as America's trail-blazing photographer. Wolcott also played a key role in the history of photography in the United States (Donna, 2009). Earlier light projecting from the camera body was unable to disperse fast enough to pass enough light deep inside the mouth. Thus, the concept of dental photography was limited only to basically facial photography, but with the invention of Lester Dine's Ring Flash in 1952, a circular flash that was attached to the end of the camera's lens, had the ability to pinpoint light directly into the patient's mouth, thus providing full illumination from external anterior to posterior intra-oral quadrant pictures. This invention revolutionized the concept of dentist/patient communication.

Compct Camera

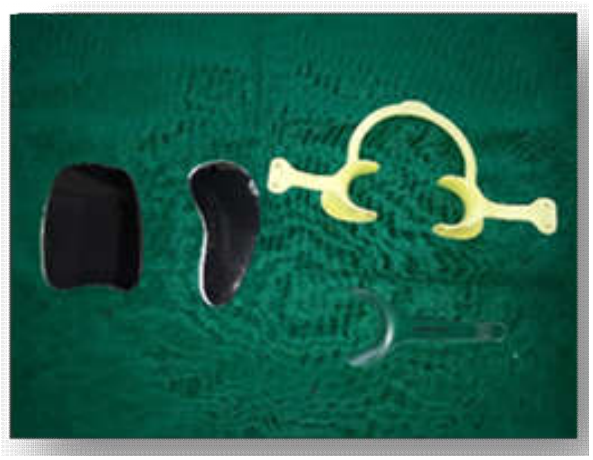
DSLR

Lens of Dslr

Equipments used in photography

- Cameras used are of two types one is compact camera or consumer camera or patient or shoot camera and another is DSLR (digital single lens reflex camera). Compact camera: very small, light in weight and easy to carry. Everything starting from exposure to focusing is automatic, moreover it is less expensive. DSLR i.e. digital single reflex lens camera: is used nowadays in this digital world. It is best for all round photography. Single lens is used for capturing images and displaying in wider view while reflex part uses a reflex mirror which reflexes the image passing through the lens towards a wider view.
- Lens which is the eye of the camera. It depends on the focal length of the camera. Lenses are of many types like ultra wide lens, wide lens, normal lens, macro lens.
- Light source is important equipment used in photography. Light used nowadays is ring flash and ring light. It is fitted in front of lens and has circular tube bulbs. It throws light in all direction and it provides a shadow less illumination.
- Films are of two types slow and fast. In digital camera films are replaced by sensors like charged couple device (CCD) and complementary metal oxide semiconductor (CMOS) for more pixels.
- Other accessories used are lip and cheek retractors and photographic mirrors for proper vision. Blower for cleaning camera

Settings of camera



Accessories Uesd

- **Flim size:** File size should be largest to incorporate all the pixels present on a sensor in an image thus, on enlarging the photograph there will be no signs of polarization.

- **Resolution:** A sufficient resolution, to record both soft and hard tissue details, is an essential feature that is useful for a dental image. The resolution of any imaging system is defined as its ability to distinguish two points as separate in space. The higher the spatial resolution, the smaller the distance between the points that can be distinguished. Higher is the resolution better will be the image quality. Resolution suggests the number of pixels that records the image. Spatial resolution is affected by how many pixels are contained on the surface of the imaging sensor, and the size of the sensor in relation to the pixel size. A Charge Coupled Device (CCD) is commonly used in capturing visual images. A CCD is an integrated circuit etched onto a silicon surface that forms light sensitive elements which is known as pixels. Photons hit these elements and generate a charge which is interpreted by electronics and thus creating

a digital representation of the object being imaged. Magnification of the image is affected by the sensor size. The smaller the sensor size the greater will be the cropping of the image (in frame) and thus, greater will be the magnification achieved.

- **Color space:** A correct color rendition index is essential to record both for soft as well as hard tissue details. It is fundamental that a dental image precisely records the color that is perceived by the eyes during dental examination. Concerning soft tissues, a correct color rendition index is an excellent method for distinguishing between healthy and diseased tissues and for recording various pathological

changes like white patches, inflammation, ulceration, burns, lacerations, carcinoma, etc. Wider the colour space more accurate will be the representation of the colour. Color combination not just only improves aesthetics but the restoration also appears natural and attractive.
RGB has wider colour space. Set the colour space to sRGB with mode 1.

- **Exposure:** Exposure is the amount of light allowed to pass through lens. Too much of exposure will led to light picture while too less exposure will led to dark picture. A good image is one which is correctly exposed**.** Exposure is usually corrected in the presence of metallic accessories such as rubber dam clamps or supports for shade guides. Such objects can cause reflections that can deceive the exposure meter that results in an underexposed image. Also the objects placed onto a black or dark background can deceive the exposure meter, resulting in an overexposed image. This is common while photographing prostheses or orthodontic appliances. An exposure correction buttons present on every camera that allows the operator to achieve excellent results by means of rapid consecutive adjustments.

- **Apperture:** Aperture is the hole in the lens through which light passes. Size of the aperture is designated by 'f-stop'. Smaller the f-stop larger will be the aperture and will give more exposure and vice versa (3). The light intensity is controlled by the lens aperture. A lens that has an aperture of f/1.4 or f/1.8 as the maximum aperture is considered as a "fast" lens, because it can pass through more light than a lens with a "slow" with maximum aperture of f/4.0.

- **Shutter Speed:** Shutter speed controls the shutter speed. A fast shutter speed (minimum 1/125 s) is required to prevent camera shake and freeze patient movements, even though a tripod is used. With electronic flashes, the shutter speed is synchronised automatically by the camera ranging from **1/60** or **1/250.**

- **ISO (Identification of sensitivity of light):** ISO (identification of sensitivity of light) is the control itself in the computer that affects the exposure. Speed of the film is designated by ISO. Larger the ISO number slower is the film which need more light and require longer exposure and vice versa. ISO **200**isgood as a general purpose film used for slower lenses which are those found on compact cameras or zoom lenses. In print film the speed is reduced to ISO **100**. ISO **400** is used when there is faster shutter speeds for action shots or in medium to low lighting conditions. Grain is getting noticeable at this speed. ISO **1000** or faster is used in low lighting conditions like in indoors and at dusk. Grain is quite noticeable. Thus, the ideal ISO for intraoral images would be from 100 to 400 and can be varied based on the lighting conditions.

- **White Balance:** White balance refers to the adjustments made in camera in different lighting condition so that it reproduces exact colour. WB should be set in the camera with the principal light source so that natural looking image can be achieved. While taking photos with a flash, the default white balance should be on the flash setting. Changing the white balance to a different setting tells the camera to compensate for the tones that are put out by that type of light and can result in discolouring in your image by giving it a different tone. A color temperature meter or setting a custom white balance using a grey card can be used to improve the image.

- **Contrast:** Contrast is defined as the separation between the darkest and brightest areas of the image (Brightness, 2018). Increasing contrast leads to increase in dark and bright making shadows darker and highlights brighter and vice versa. Contrast should be set as **minus or low**. An increase in contrast may led to burn out or mid tone colours.
- **Saturation:** Increase in saturation leads in an increase in contrast, brightness and sharpness. Change in saturation normally has a more noticeable effect on vibrant colours and less on dull colours that are almost natural. Saturation should be set to normal so as to reproduce close to natural colour.

- **Sharpness:** Sharpness can be defined as edge contrast i.e., contrasts along the edges in a photo. Increase in sharpness increases the contrast only along or near edges in the photo and thus leaving smooth areas of the image alone. Sharpness should be low or nil. Unnecessary increase of sharpness may result in burning of the detail in areas falling in shadows that may be essential in clinical work.

Photographs taken in dentistry

- Facial photographs for which head should be in FH plane, eyes should be open, shadow should be avoided and photographs should be clicked without using flash. Facial views are (Boudet, 2017):
    - Full face front view
    - Profile view
    - Smiling view
- Intraoral photographs for which scaling and polishing should be done and saliva should be absorbed. Intraoral views are:
    - Front retracted
    - Right lateral retracted
    - Left lateral retracted
    - Upper occlusion
    - Lower occlusion.

Photography and dentistry

There are many reasons for using dental photography today, the main purpose of digital dental photography is recording accurately the clinical manifestations of the oral cavity.

Settings in dslr

Other uses include legal documentation, publishing, education, communication with patients, dental team members, colleagues and technicians, and finally marketing. Each of these uses enhances and elevates the status of dental practice. It also improves delivery of care to patients.

- **Diagnosis and treatment planning**

  - Dental photography assists the operator in initial examination of the patient, helps him in the diagnosis and control of the medical care outcome over time. Thus dental photography must be considered as a diagnostic tool, like X-rays, or other tests and investigations.
  - Intraoral photography is useful for detection of caries and caring out dental epidemiological studies in children. The photographic assessment method of dental trauma is as valid and reliable as that of oral clinical examination.
  - Extra and intra-oral photographs are an important diagnostic tool for orthodontics. Orthodontics uses it during dental therapy to evaluate the progress of the treatment plan. Facial photographs assume a greater importance while caring out facial analysis. Many times a dentist does not have equipment permitting him to take cephalometric radiographs than these photos plays a vital role. The move to digital photography offers many advantages to orthodontists. High quality photographic documentation must be taken throughout treatment.
  - Photodocumentation can conform the diagnosis sharing critical information with oral pathology specialists. Photodocumenting oral lesion increases the treatment acceptance by enabling more effective patient communication and thus helps to ensure that oral lesions are properly recorded (Digital photography enables better soft tissue screening, diagnosis and case acceptance).
  - Shooing the photos of a case and posting on internet immediately can yield valuable advice in a short time from colleagues worldwide, which can be useful to provide an immediate solution to the dentist's queries.
  - Photos are used to evaluate prosthetic rehabilitation or gingival health and periodontal pocket or even ridge morphology prior to implant placement. Pictures provide an improved documentation and the option for monitoring particular situations after long period of time.
  - Digital photography allows for accurate determination of the incisal edge position, both horizontally and vertically so as to restore the anterior teeth in proper form, function and aesthetics.
  - Diagnostic records should be taken as part of a complete examination. This includes perfect upper and lower impressions, facebow transfer, centric bite record and digital photos. Photos helps in evaluating position of incisal edge of the tooth and these are used in 2D treatment plan checklist (Casaglia, 2015).
  - Photographs should be added up with radiographs especially in conditions when X-rays do not support the clinical observations. A visual record of the patient's periodontal condition is needed for consultation purposes.

    Bleeding on probing is present with no radiographic evidence of bone loss while a full-blown, marked gingivitis can only be documented photographically.

DOCUMENTATION

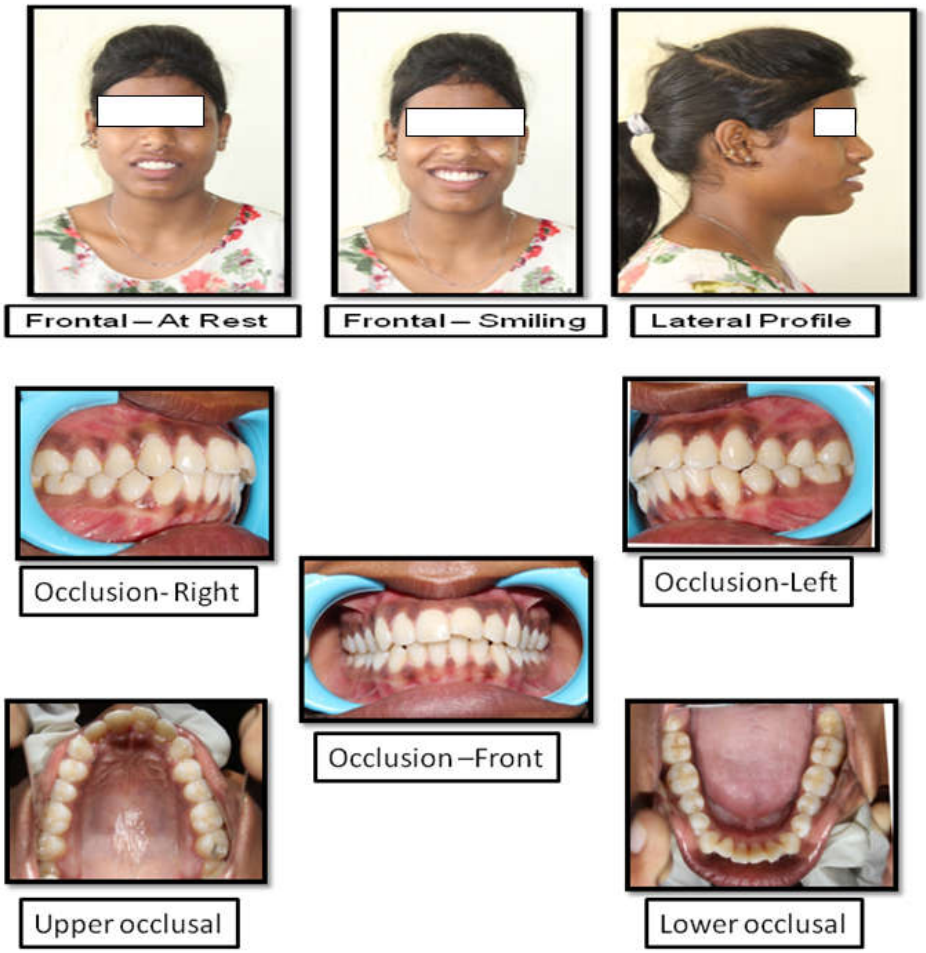
- The main aim of dental photography is documentation of dental treatment which consists of photographs demonstrating the entire process and stages of therapeutic treatment.
- Surgical treatments as well as aesthetic treatments are recommended to be explained with the help of pictures. Furthermore, photographs should be taken of patients who appear to be suspicious or overly anxious about the treatment they have got ready to do the treatment, or those who had previous legal activity with a dentist. The starting and ending conditions of the patient during entire treatment in such cases should be documented.
- In today's medico legal environment, a pre-treatment and post-treatment series of photographs is very much important. By having these photographs a dentist can easily prove the initial condition and condition after treatment done by him/her.
- Images should be made prior to each invasive and non invasive procedures, which results not only in a bunch of interesting dental files but it also shows those forensic elements as well, which have importance in judicial-medical, investigation and proof finding procedures.
- Forensic dentistry refers to the application of dental science, especially through photographic documentation to legal matters. The forensic dentist are mostly concerned with identifying human remains, the processing and analysing of bite marks or dental-related trauma for court evidence become **necessary (**Neeraj Khanna, 2013**).**
- The photograph is often plays a vital role as accurate documentation of perishable evidence.
- In each and every case, evidence must be preserved, especially when the specimen are available for a short period of time before decomposition, burial, or healing occurs.
- All photographs taken as evidence should be labelled with the location, date, time, subject, and photographer's name and should also include information like camera, lens, film, lens aperture, subject distance, shutter speed, or flash setting used.

Labouratory Communication

- This communication tool enhances communication between the dentist-technician team, specialists, and

various members of the restorative team, which results in increase patient satisfaction and restorative success.

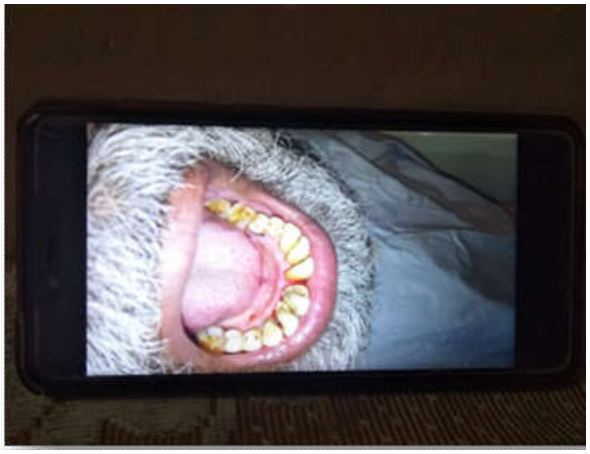
ultimately resulting in better understanding of a proposed treatment plan, higher case acceptance, and improved practice productivity



- The incorporation of digital cameras into clinical dentistry has enabled us to obtain images using real-time shooting modes. Transference of the digital information to the laboratory in the form of a jpeg, tiff file or bitmap is easy through the internet (e-mail). The laboratory can then use the image directly and correlate it to a specific shade tab, or convert the image to a grey scale in Corel Photoshop and from which the value of the surround teeth can be obtained.
- In order to obtain the best possible results in prosthetics it is important to forward images of each step of treatment to the dental technician. Notes can be sent with photos to communicate such as color, shape, alignment, characterizations, regions of translucency, etc.
- Many photographs should be taken from different angles and under different light sources. Photograph of patient's occlusion should be taken with the photographs of the teeth being working on. Photographs also tell the technician about the patient, his or her age, personality and character.
- The accuracy of communication between a dentist and dental technician is directly proportional to the quality of photos taken.

Education and Communication

- Patient education and communication: Visual aids help educate patients on diagnosis and proposed treatment,
- Patients can be educated with the visual aids about diagnosis and proposed treatment, which results in better understanding of a proposed treatment plan, higher case acceptance, and improves practice (Kataoka, 2016).
- It is extremely useful in explaining of a number of different treatment options to the patients.
- Pre-treatment and post treatment images suggests how the patient would look after giving any particular treatment is becoming increasingly popular.
- For further diagnosis, treatment or a second opinion photographs can be send via email attachments, drop box or via pen drive, CD or DVD to the other dentist. It saves the time in malignant conditions. Photography plays an important role in academics in many ways. It is useful in preparing university lectures, conferences or poster presentations, and to publish postgraduate books or articles. Many dental journals strictly mention publishing criteria for images (Terry, 2008).
- Use of photos in various informative magazine editorials increases patient awareness/knowledge and enhancing brand awareness.
- Thus, with the proper training, techniques, equipment, and implementation, dental photography significantly enhances the level of treatment provided.



Mobile Dental Photoraphy

MARKETING

- The most effective means of internal marketing is proper practice management, and the use of photographs can help to market the practice in numerous ways such as newsletters and welcome packs. For external marketing the most effective way is via your website which can be greatly enhanced by including photographs of work you have carried out, to engage prospective patients.
- Day by day the importance of digital marketing is increasing. Advertising is done though telephone directories, local televisions, newspapers or radio, but Internet is the faster way for advertising.
- Around 3.6 billion people are connected to the Internet on their phones. In Europe, the density of mobile users and social media users is incredibly high with many prospective customers for dentists. Dental practices can target this group by using digital marketing to their advantage.
- Now a days almost every one using internet thus marketing can be done through networking sites like Facebook, Twitter, Google, LinkedIn, etc. There is huge chance for increasing the no. of potential patients via internet.
- Go

Mobile Dental Photography(MPD)

- **Mobile Dental Photography (MDP)** has been gaining more and more attention in recent years as smartphone technology advances in every field like sensor quality, resolution, lens sophistication, leading to much more improved image quality. More over smartphones are lighter in weight and easy to carry as compare to DSLR (Shadi Samawi, 2017).
- Very high ISO settings can be made with low noise. Wide aperture in a very small camera provides a high depth of field. A better resolution can be maintained. White balance, exposure and focus can be operated manually. Battery backup provides more working time.
- Smile Lite Photography also known as "mini photo studio" made in Switzerland is a device which is equipped with universal adaptor which is adjustable to any smartphone. It consists of 3 LED lights. It is easy to use and it doesn't require any app for functioning (Hardan, 2014).
- It improves the results of the smartphone drastically.
- It is used for documentation, shade matching, lab communication, etc.(Hardan, 2017).

Softwares used in dental photography

- **Dental Practice Management Software are (Digital, 2018)**
  - Open Dental
  - Eaglesoft
  - Dentrix
  - Curve
- **Photography software** are:
  - Adobe Photoshop,
  - Gimp (freeware)
  - Apple Aperture
  - XARA

REFERENCES

Albert Yoo, 2014. Reasons why dental photography should be an essential part of YOUR practice September 30, accessible at www.dentaleconomics.com

Boudet, C. A. An Introduction to Dental Photography, Chairside magazine, vol 2, issue 2 accessible at glidewelldental.com

Brightness. contrast, saturation and sharpness accessible at www.steves-digicams.com

Casaglia, A., P. De Dominicis, L. Arcuri, M. Gargari, L. Ottria, 2015. Dental photography today. Part 1: basic concepts Oral Implantol (Rome). 2015 Oct-Dec; 8(4): 122–129

Digital Dental Photography, Digital Photography and Workflow for Dentist accessible at www.dentaldigitalphotography.com

Digital photography enables better soft tissue screening, diagnosis and case acceptance.

Donna l. 2009. Galante Journal of California Dental Association Volume 37 no. 3 March page – 173

Dr. Alexander Teckkam, 2018. What is the best camera for dental photography,Nov 3, 2017

Dr. Neeraj Khanna, 2013. Why dental photography is important to an accurate diagnosis, The Dawson Academy Blog.

Dr. Shadi Samawi, 2017. There's Something About MDP (Mobile Dental Photography)!, The orthodontic note file.

Hardan, L. and Manauta, J. 2014. Mobile dental photography. Part I8 Jun 45516

Hardan, L. Smile lite MPD Mobile dental photography accessible at www.smileline.ch

Kataoka, A. 2016. Excellence in Dental Photography, Focus on Photography, the Journal: winter: 24-25,

Terry, D.A., Snow, S.R., Mclaren, E.A. Contemporary dental photography: Selection and application, functional aesthetics and restorative dentistry: series 1, number1 :38-39

The Fathers of Photography, The Photographic Studios of Eastern Europe accessible at www.museunoffamilyhistory.comq

****