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Photography In Orthodontics

A Project Submitted to

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صدق الله العظيم

Certification Of the Supervisor

I certify that this project entitled" Photography In Orthodontics" was prepared by the fifth-year student "**Hajer zubir sabar**" under my supervision at the College of Dentistry/ University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Supervisor's name: **Dr. Samher Ali Al-shaham**

Date: 8/5/2022

Dedication

I dedicate my humble effort to my father who was and still the shining candle in my heart

To my beloved mother, without her love and prayers, I would never have been here.

To my brothers and sisters, thank you for your continuous support throughout my study career.

Acknowledgment

First and foremost, praises and thanks to the **God**, the Almighty for helping me fulfill my dream, for his blessings throughout my work to complete it successfully.

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Abbreviations	Meaning
CBCT	Cone-Beam Computer Tomography
DSLR	Digital Single Lens Reflex
mm	Millimeter

Introduction

Photographs are an essential part of clinical documentation. Current 'best practice' is a full set of extra- and intraoral photographs, both at the start and completion of a course of orthodontic treatment and, ideally, some mid treatment photographs showing key-stages in treatment **(Sandler, 2000),** If taken correctly, they offer useful information about the patients malocclusion and treatment progress **(Mckeown et al., 2005).**

The history of dentistry and photography began in 1840 when the first dental school was opened with the world's first photographic gallery and was operated by a dentist turned photographer. Since then, photography and dentistry have been partners as photography became an integral part of a patient's record and treatment plan **(Glenner, 1990).**

Photography provides the operator the ability to record patient data, events, and document scientific discoveries in a unique way. Alexander Wolcott (1804–1844) played the key role in the history of photography. He obtained the patent for his inventions of a camera in 1840 and developed a system for photographic studio lighting. Soon after 1 month, he made history by opening the first commercial photographic studio**(Galante, 2009).**

In 1848, Dr. Richard Thompson and William Elde of Columbus, Ohio, marked the first time use of before and after photographs of dental procedure and an article was published creating a new frontier in diagnosis and treatment planning dentistry. More recently, dental profession has started to use clinical photography as part of diagnostic and treatment planning processes. Its value in documenting cases, presenting information,

and educating patients has increased to the point that it has become integral to diagnosis and treatment planning decisions **(Glenner, 1990).**

Digital photography arrived in mid-1990 with digital cameras available at the marketplaces, Although its resolution was low, it had already started to create ripples of interest among the purists and enthusiasts. Within 10 years or so, digital photography has completely displaced film photography in science and medicine. New software has come which allow things to be measured, changed, shared, and integrated into new communication tools with just a click of a mouse. The images also can now be animated, used in reports, and published in websites. These applications are unparalleled in film technologies **(Bengel, 2006).**

Aims of the study

1.To highlight the importance of photography in treatment plan as well as role in orthodontic records.

2.To highlight the photogrammetric soft tissue facial profile management.

3.To verify the importance of standardized photographic techniques.

Chapter one

Review of literature

1.1 Facial Soft Tissue Importance:

One of the most important components of orthodontic diagnosis and treatment planning is the evaluation of the patient's facial soft tissue. Since the shape of the human face depends on both the structure of the hard tissue (bone) and the soft tissue that covers it, soft tissue should be analyzed for the correct evaluation of an underlying skeletal discrepancy because of individual differences in soft tissue thickness. The quantitative assessment of the size and shape of the facial soft tissue is widely used in several medical fields such as orthodontics, maxillofacial and plastic surgery, and clinical genetics for diagnosis, treatment planning, and postoperative assessment **(Fariaby et al., 2006;Baik et al., 2007),** Obtaining measurements of the facial soft tissue is important in terms of achieving aesthetic criteria **(Porter and Olson, 2001; Baik et al., 2007),** With the recent advances in surgical techniques, facial harmony is considered and even incorporated as a treatment goal.

Analyzing the human face is a science and an art, utilizing both aesthetic and anthropologic tools. Various methods have been used to evaluate facial characteristics, such as anthropometry **(Farkas and Munro 1981)**, Photogrammetry **(Gavan et al., 1952)** and cephalometry **(Garner, 1974)**. The application of photogrammetry in orthodontics was first proposed by Stoner**(Stoner, 1955)**, who compared pre- and post-treatment profiles with ideal profiles. Different authors have included soft tissue parameters in photogrammetry, and various facial soft tissue analyses based on standardized photogrammetric method have been described **(Fernandez-Riveiro et al., 2003;Epker, 1992)**. Other photographic methods have also been used to

quantify facial aesthetics**(Peerlingset et al., 1995)**. Facial soft tissue analysis has been conducted using newer three-dimensional (3D) methods **(Ferrario et al., 2000; Sforza et al., 2008)**, such as laser surface and, more recently, scanning digital 3D photogrammetry**(Baik et al., 2007)**. Photogrammetry has been introduced as an alternative to direct measurements to obtain distances between facial landmarks using both two-dimensional and three-dimensional methods. Obtaining measurements from photographs is less intrusive to the patient, more cost-effective, provides a permanent record of the face that can be accessed at a later time.**(Guyot et al., 2003;Zhang et al., 2007)**.

1.2 Methods of Facial Measurements:-

Various methods of facial analysis result in many linear and angular measurements.**(Reynecke and ferretti, 2012)**, the most important methods of facial measurements are :

1.2.1 Direct methods

1.2.1.1 Craniometry:

Craniometry, physical measurement of dry skulls, was one of the first scientific methods for obtaining measurements of the head and neck. This method dates back to ancient Greece, but the use of measurements to compare skulls was not developed until the 17th century **(Findlay, 1980).** Many of dentoskeletal landmarks could be defined and identified by craniometry Fig(1.1) **(Payne, 2013).**

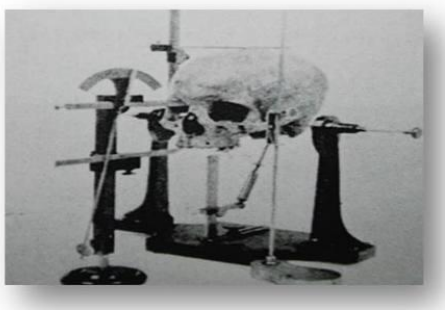

Figure1.1 Apparatus used for craniometry devised in 1902 (**Premkumar, 2011).**

1.2.1.2 Anthropometry:

Anthropometry has been developed when craniometry showed inability to measure longitudinal changes, Hrdlicka was considered the "father of medical anthropology", he used calipers and rulers to record direct facial measurements from individuals over an extended period of time **(Payne, 2013).**

The use of anthropometric measurements in orthodontics was also adopted in the early 20th century which provided a standardized and comprehensive method to evaluate facial aesthetics and quantify changes to facial structures during growth and treatment **(Fakas, 2005)**. Anthropometric measurements were still being used to quantitatively measure different aspects of aesthetics in orthodontics, such as dimensions of the teeth and characteristics of the smile but indirect techniques have been used more frequently in the orthodontic field Fig(1.2)**(Sarver, 2004;Proffit et al., 2013).**

Figure1.2 Facial measurements for anthropometric analysis**(proffit et al., 2007).**

1.2.2 Indirect methods:

1.2.2.1 Cephalometric Analysis:

Cephalometric radiographs was introduced by Broadbent **(Broadbent, 1931).** Cephalometric analysis is used to evaluate the formation of the facial skeleton, the relationship of the jaw bases, the axial inclination of the incisors,

soft tissue morphology, growth patterns, localization of malocclusion **(English et al., 2009).**

Although the cephalometric radiographs played a major and important role in quantitative diagnosis and treatment planning in orthodontics, and the use of cephalometry offered the ability to measure the soft tissue profile outline and quantify changes over extended period of time from growth and treatment **(Burstone, 1959);** the use of cephalometric radiographs for extended evaluation has limitations, such as cephalometric radiographs were a two-dimensional representation of three Dimensional craniofacial structures, which lead to distortion of dentoskeletal structures based on the plane in which they lie **(Baumrind and Frantz, 1971)** and exposure of patients to ionizing radiation repeatedly has proven to have detrimental and harmful effects, especially when taking progressive radiographs (**Mupparapu, 2005;Fazel et al., 2009;Claus et al., 2012).**

1.2.2.2 Photographical Analysis:

The photographs are an excellent aid in appraising facial balance, type and harmony of the external features. In addition to that it may reveal things that were not seen during clinical examination , Photographs must be clear, sharp and large enough to see with the naked eye **(Down, 1956)**.Photographs can be used to assess the symmetry of the face, profile and facial types, serves as a record of the patient and to assess the progress of a case by comparing the preoperative and postoperative photographs **(Lee et al., 2010).**

Photographic analysis has several benefits over the radiographic analysis, such as absence of harmful exposure of the patient to radiation, evaluation of craniofacial structures including the contribution of muscles and adipose tissue, stable hardware, availability of technical assistance (**Ferrario et al,. 1993**).

Photographs could be easily taken from multiple angles, allow facial soft tissue dimensions to be fully assessed and evaluated, this benefit is not possible with cephalometry**(Mayerson and Steward, 1995).**

1.2.2.2.1Standardization of Photography:-

Standardization means the use of standardized camera components, lighting, distances, and photographic technique to make photographic analysis more valid and reliable, as following:

Camera The camera must be of a suitable lens, many investigators recommend a lens with a focal length of 100mm or 105mm which will produce the least distortion (**Claman et al., 1990;Meredith, 1997),** to prevent blurring of image , it is recommended to fix the camera on tripod **(Ahmed, 2020).**

Lighting System: The lighting system must prevent any shadows that may adversely affect the quality of the photograph or obscure any of the landmarks , some use the natural daylight and some practitioners use a flash umbrella for soft facial illumination **(Meredith, 1997).**

Photographic Technique: A photographic technique that ensures the best reliable images has to be utilized. That includes :

- **Positioning of the head**: some authors use the Frankfort-Horizontal line as *a* base to position the head and Others use the natural head position method **(Leivesley, 1983, Meredith, 1997).**
- **Object-lens distance**: it was found that a distance of 7 feet (about 2.13meter) is the most appropriate camera-to-object distance for the photograph to be with least distortion **(Benson and Richmond, 1997),** while **Meneghini (2005)** suggested that the 1.10 meter as a good distances to give high quality photograph.

- **Background**: Should be such that it dose not interfere with assessment of profile it should be non-reflective (**Paredes et al., 2006). Dickason and Hanna (1976)** found that the most acceptable colors for the background are light blue and gray blue**.**

1.2.2.2.2. Type of Photographs used in Orthothodontics:

a.Facial Photographs (extra-oral): providethe clinician with maximum possible information about the patient's facial and soft tissue features, proportions, and overall smile esthetics **(Sandler and Murray,2002).**

❖ ***Frontal (resting) view:*** Lips and mandible should be at resting position While capturing this image, the patient's head should not be skewed, face should be directed to the camera, and the image should be captured while midline is positioned perpendicular to the camera. Pupil line should be parallel to the ground fig(1.3.a) **(Samawi, 2012).**

❖ ***Frontal dynamic (smile) view:***This recommended to demonstrate the amount of incisor show on smile (percentage of maxillary incisor display on smile), as well as any excessive gingival display (fig 1.3.b).

❖ **Profile view:** Profile photos should be taken while the head is at the neutral position and the Frankfort horizontal plane is parallel to the ground, The most common way of maintaining a neutral head position is looking in a mirror **(**fig 1.3.c). **(Williams, 1985).**

❖ **A three-quarter view photograph:** While capturing this images, the patient is rotated to 45°.This could be quite useful for examination of the mid-face and is particularly informative of mid-face deformities, including nasal deformity (fig 1.3.d).

❖ **An optional submental view:** Such a view may be taken to document mandibular asymmetries(fig 1.3.e)

Figure1.3 : Exra-oral photographs **(Sullivan, 2002)**

b.Intra-oral Photographs:

The intra-oral photographical series consists of five views: right and left lateral (Fig1.4.a,b), frontal (Fig1.4. c) and upper and lower occlusal views (Fig1.4. d, e), the major purpose of the intra-oral photograph is to enable the orthodontist to review the hard and soft tissue findings at the clinical examination as all the diagnostic data were being analyzed **(Graber and Vanarsdall, 2000; Sandler and Murray, 2002) .**

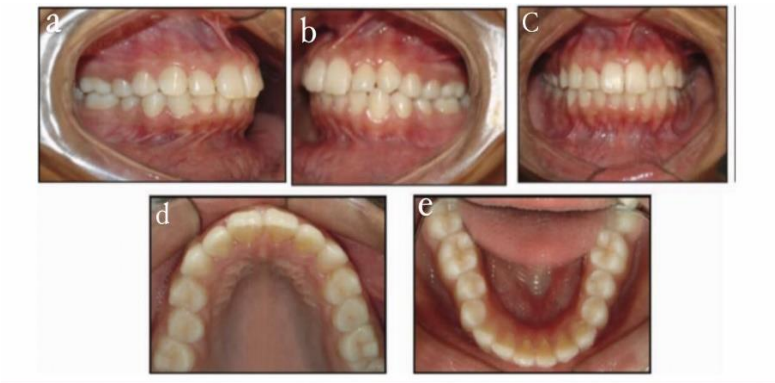

Fig1.4 : Intra-oral photographs **(Singh, 2007).**

1.2.2.2.3<u>Purpose of Photographs:</u>

a) Treatment planning: When devising treatment plans in the confines of your office, without the presence of the patient, it is not always possible just from clinical notes, radiographs, and study models, to recall the important features of each patient as well as the finer details of their malocclusion.High quality photographs will assist you in recalling both intra- and extraoral features which will have an influence upon different possible treatment plans.(Fig1.5) **(Mizrahi, 2015).**

Fig1.5 : Upper or lower dental central line deviation

From mid-face must also be recorded on the clinical notes **(Mizrahi, 2015).**

b) As an aid during treatment : Many times during treatment it is helpful for you to recall the original malocclusion and even what teeth looked like at the last visit. Instead of having to retrieve the study models, it is far easier to access the photographs, which ideally should be available on a computer screen at the chair side, Only by studying the changes achieved on a visit by visit basis can the clinician learn which treatment techniques are the most efficient and which are least effective **(Mizrahi, 2015).**

c) Case discussions: When consulting with a child and their parents or an adult patient, they are immediately drawn to and fascinated by their own photographs on the flat screen monitor as shawn in figure(1.6) , They have rarely seen their teeth from this aspect and close up photographs highlight the detail of the malocclusion. Photographs aid in explaining to the patient adverse tooth positions and gingival conditions, as well as relevant features of the patient's smile and profile. The photographs can also be used to demonstrate what kind of appliance therapy might be used to correct the malocclusion or what the effects of treatment might be **(Mizrahi, 2015).**

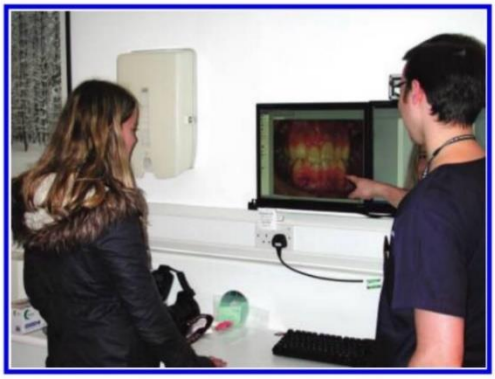

Fig1.6: Consultation with parent and children greatly aided by clinical photographs **(Mizrahi, 2015).**

d) Practice builder and marketing tool: At the end of treatment, when the patient is looking in the mirror and seeing their actual teeth after debond, showing them the original photographs boosts their feeling of satisfaction and appreciation for what you have done for them. Printing out the start and finish photos for the patient will provide them with something they can show all of their friends and It is also very useful to send a 'before and after' set of photographs, with the patient's permission, to the referring practitioner to demonstrate the quality of treatment that you would be willing to provide for their patients. Again and impressive treatment result will no doubt be shown to other clinicians in the practice which should lead to further referrals in the future (Figure 1.7.a,b) **(Mizrahi, 2015).**

Fig1.7: Degree of anterior open bite closure demonstrated by (a)before and (b)after photographs **(Mizrahi, 2015).**

e) As a defence tool in medico-legal conflicts: Photographs can help enormously to document the case when you last saw the patient. Occasionally patients fail to attend their follow-up appointment. When they do eventually return for brace removal you want to be able to demonstrate they were in good shape when you last saw them and that effort had been made to follow them up (Figure1.8.a.b) **(Mizrahi, 2015).**

Fig1.8 : (a) Extended period away from the orthodontist showing evidence of neglect. (b)Last photo taken 9 years earlier show teeth in good shape **Mizrahi, (2015).**

1.2.2.3 Cone-Beam Computer Tomography Analysis:

Three dimensional (3D) cone-beam computed tomography (CBCT) has rapidly gained prominence in the dental community and is quickly becoming a routine imaging modality for many orthodontics **(Grünheid et al., 2012).** The technology of CBCT has improved since its introduction into the United States market in 2001, allowing more affordable machines to become commercially available **(Hatcher, 2010).** This has resulted in a significant enhancement in the radiologic information gained by clinicians. For instance, CBCT has been reported to allow more accurate diagnosis of skeletal asymmetry, easier location of impacted teeth, improved surgical planning, and increased detection of pathologies Fig(1.9) **(Kaeppler, 2010).**

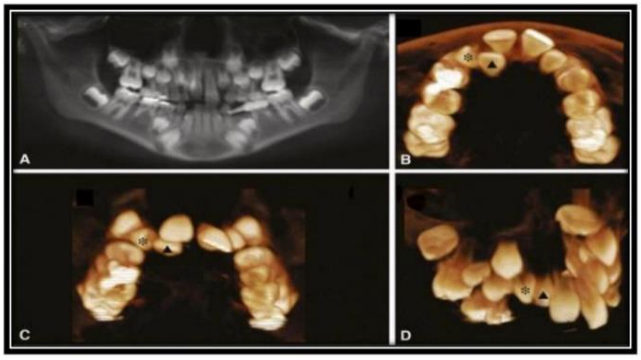

Fig 1.9: CBCT images offer important information and finer details in treatment planning of supernumerary teeth **(Kapila et al., 2011).**

1.2.2.4 Video-Imaging Analysis

Video-imaging has been recently used to make a dynamic measurements of facial soft tissues, rather than static measurements from other indirect methods, the video-imaging in orthodontics has been used for measuring dynamic overments of the soft tissue during smile animation, this technique improved visualization of the soft tissue contour by recording the face from different angles **(Sarver, 1996).**

1.2.2.5 Computer (Digital) Imaging

A digital image is a matrix of square pieces, or picture elements (pixels) that form a mosaic pattern from which the original image can be reconstructed for visual display .The pixels in a digital image are arranged in a matrix.the resolution of the image improves as the number of pixels increases.**(Mayerson and Stewart, 1995).** Compared to traditional photography, digital photography has the following advantages: **(Mayerson and Stewart, 1995; Scholz, 1998).**

1. No film and processing expenses,
2. Inexpensive storage.
3. Immediacy of viewing unlike traditional photography, which usually requires several days for processing and only then, the clinician identifies any exposures that are unacceptable.
4. Infrequent need for retakes ("what you see is what you get") the quality of the image can be assessed at the time the image is taken as one has a chance to preview it before saving it to disk.
5. Inexpensive and immediate duplication, with no degradation of quality.

Ability to transmit by modem; a scanned photo can be sent as an attachment to an e-mail note to referring doctor thus avoiding the cost and mailing time **(Scholz, 1998)**.

1.2.2.5.1Classification Of Digital dental camera:

Digital dental cameras can be divided into 3 categories (Bister et al,. 2006):

- ***The compact point-and-shoot cameras, without interchangeable lenses*:** This type of camera allows varying amounts of exposure control and mixed results in the unique setting of the oral cavity. Full-face photos can be acceptable, but intraoral and close-up views remain variable.

- **second type of camera used is the DSLR (Digital single lens reflex) camera:** DSLR cameras are designed for semi-professionals to professionals. DSLR cameras have the advantage of interchangeable lenses, including macro (or Micro in a Nikon System), telephoto and metered lenses. these cameras can be expensive and bulky**.**
- **Intraoral cameras:** An intraoral camera is a tiny device with a video camera that moves around inside the mouth and generates a surface video examination of the teeth.

1.2.2.5.2 Camera Accessories (Claman et al., 1990).

- ***Lense*:** A lens selected for dental purposes must be able to capture diagnostic and accurate views of teeth, gingiva and surrounding structures .Macro lenses with a fixed focal length designation of 85 to 105 mm provide the ideal combination of magnification ability and working distance convenience for dental purposes. The quality of the lens has a significant influence on the sharpness, clarity, and ultimate quality of the final image **(Devigus, 2006).**

- ***Flash*:** Is used primarily to avoid shadows and illuminate the subject in a predictably uniform manner. Various types of lashes 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 the option to use **(Claman et al., 1990).**
  - **Memory card**
  - **Batteries**
  - **Camera Bags**

1.2.2.5.3 Clinical Dentistry Photographic Accessories:

- **Cheek Retractors :** The recommended cheek retractors to be used for best results in clinical photography There are two sets of double-ended retractors; one set with a regular and small size either end. These are mainly used for intra-oral occlusal shots (mirror shots). The other set has a narrow end and a wide end on the other. These are used for intra-oral frontal and buccal shots fig(1.10). **(Sandler and Murray, 2001;Sandler and murray, 2002)**

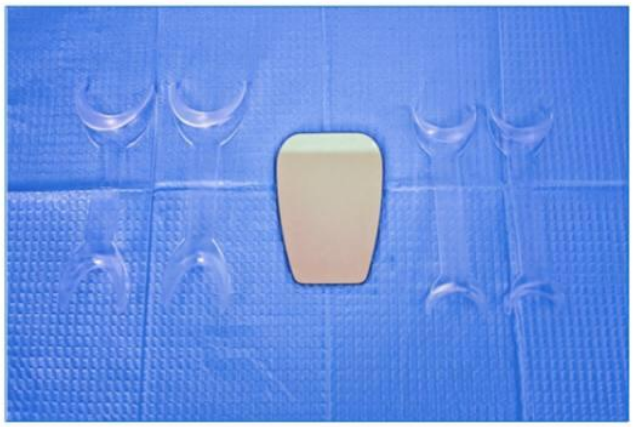

Figure 1.10 : Large and Small Double-ended Cheek Retractors and Medium-sized, Front-silver coated Dental Mirror**.(Sandler and Murray, 2002)**

Technique for inserting retractors(Manjunath et al., 2011) :

a) Ask the patient to relax the lips and open the mouth slightly.

b) Place the rim of the retractor onto the edge of the lower lip.

c) Rotate the handle of the retractor until it is parallel to the corner of the mouth.

d) Repeat this for the other side of the mouth if necessary.

e) Instruct the patient to bite down on the posterior teeth. Pull out the retractors laterally and slightly forward.

- **Intraoral mirrors:** Intraoral mirrors are used to provide a reflected image when areas of difficult access are photographed. mirrors are available in several sizes for both adults and children , Many types of mirrors may be used for clinical photography, ranging from front-silvered mirrors to highly polished Stainless Steel mirrors of various shapes and sizes. Many authorities in the field recommend front-coated silvered mirrors as they offer the best image quality and light distribution over other types of mirrors(figure1.10). It is generally preferred to use long-handled mirrors (figure 1.11) as they allow better control and handling by the clinician during the occlusal shots **(Sandler and murray, 2001;Sandler and murray, 2002).**

Fig 1.11 : longe handled mirrors **(Mckeown et al., 2005)**

Technique for inserting Mirrors (Nayler, 2003) :

a) Place the mirror in warm water before use to prevent fogging.

b) Insert the appropriate cheek retractors.

c) Select the mirror and the appropriate end for the desired view.

d) Place the mirror flat into the mouth,take care not to hit the teeth or press into the alveolar process, as this is uncomfortable for the patient.

e) Hold the mirror securely at the opposite end while maintaining retraction.

f) If fogging occurs, blow a gentle stream of compressed air onto the mirror.

1.2.5.4 Sources of Errors in Clinical Photography

There are many potential sources of errors while obtaining photographs. Photographs of inadequate quality may misrepresent the patient's initial malocclusion, may inaccurately reflect the progress or may incorrectly record dental anomalies and defects which may be present. **(Mckeown et al., 2005).**

Camera: Correct camera orientation is important, with extra-oral photographs taken in portrait mode and intra-oral photographs taken in landscape mode. To allow direct comparison of photographs taken at different times consistent magnification of images is required. To aid this with conventional equipment a label can be placed on the barrel of the lens indicating the required lens setting (focal length) for each of the standard the magnification will therefore be preset for intra-oral, mirror and extra-oral views allowing direct comparison of sequential shots **(Sandler and Murrary, 1997).**

Retractors: For both occlusal shots the assistant inserts the small ends of the small retractors under the respective lips and rotates them towards the midline pulling the lips forward, as well as laterally. This is essential to prevent obscuring the teeth with the lips. The direction of pull is away from the teeth, and upwards for maxillary shots and downwards for mandibular shots, thus ensuring a background of reflected mucosa rather than stertched vermillion (Figure 1.12) **(Sandler and Murray,1997; Sandler and Murray 2002).**

Fig1.12: Assisstant pulls up,laterally and towards the photographer **(Sandler and Murray, 2002).**

Mirrors: Long handles are held by the photographer to allow complete control of the picture and to keeps assistants fingers out of the shot . Glass mirrors produce a far superior photograph compared to polished metal mirrors as there is much greater reflection of the light and they are more resistant to scratching. Silvering on the front side of the mirror prevents double images, which occur due to a second reflection from the glass surface when the silvering is on the back surface (Figure1.13) **(Sandler and Murray,1997;Sandler and Murray, 2002).**

Fig1.13: (Top) Ghost image from glass and image from rear silver (Bottom) sharp image when front silvered surfaced used **(Sandler and Murray,2002)**

Shadow: The Single Point Flash built into most compact digital cameras and some DSLR may occasionally produce fairly good light distribution when used for clinical photographs, but the results are very inconsistent and largely depend on camera orientation and pre-existing lighting conditions in the clinic. Dark distracting shadows, which may obstruct important details frequently occur. These are often irreparable even by using image editing software, and will detract from the final quality of the image, and possibly the information gained from it. In contrast, A dedicated (Ring Flash eliminates almost all shadows by providing a more even distribution of light during extra and intra-oral photographs and thus the quality of the image is enhanced due to overall better illumination (Figure1.14). **(Terry et al., 2008;Sandler and Murray, 1999).**

Fig1.14: Flash effect in photography **(Mckeown et al., 2005).**

Positioning Errors : Both the patient and the clinician need to be positioned correctly, in a standardized manner, to produce consistent photographs. All features of the malocclusion should be demonstrated, and areas of interest not obscured by clothing, hair, impression material, retractors or saliva. Problems may be encountered where there is a height difference between the patient and the clinician, and it may not be possible to get a uniform background as the photographs may appear to be taken above or below the patient. This problem can be solved by getting the patient or the clinician, which ever is appropriate, to stand on a platform to raise them to the same height The required photographs and the objectives for each shot have been previously outlined (Figure1.15). **(Sandler and Murray,1997;Sandler and Murray**, **2002).**

Fig1.15: height adjustment for photographer and the patient should be possible **(Sandler and Murray 2002).**

Chapter two

2.1 Discussion:-

It has been always said that: facial beauty is arguably the most powerful generator of human emotion, it has served to inspire great works of art; prompt sadistic acts, and initiate ferocious wars; It might be expected that beautiful faces would display an understanding of the soft tissues and their normal ranges enables a treatment plan to be formulated to normalize the facial traits for a given individual **(Arnett, 1993).** The photogrammetric technique is simple, low coast, non-invasive tool and can be valuable.

It is worth remembering the proverbial adage, '***a picture really is worth more than a thousand words***', especially if one has to type them. A printed photograph is ideal for educating patients about a specific treatment modality, or for showing the current state of their dentition and subsequent improvement after therapy. However, prints are not a good method for archiving. On the other hand, electronic storage is preferred for permanent archiving and retrieval as it is environmentally friendlier, but is more cumbersome and not readily available to hand compared to prints **(Mew, 1993).**

Various methods have been used to evaluate facial characteristics, such as anthropometry **(Farkas, 1981),** photogrammetry **(Gavan et al., 1952; Stoner, 1955; Neger, 1959),** computer imaging **(Czarnecki et al., 1993)** and cephalometry **(Roos, 1977).**

A series of facial photographs has been a standard part of orthodontic diagnostic records for many years **(Proffit et al., 2013)**. Photographs are an essential component of comprehensive orthodontic investigations, they may be taken as conventional colour photographs, Polaroid photographs, colour slides or digital

photographs, personal preference will dictate which of these formats you choose for your practice.

Photographs on the other hand are excellent for patient communication but of limited value for lecture purposes. In digital photography any problems can be easily rectified immediately. Direct digital photography, which converts the images almost immediately into a digital file, has many beneficial advantages in dentistry, such as, one can see images almost immediately, allows for immediate retakes when needed. Can make 100% exact duplicates and media can be reused meaning no additional cost of film or its chemical processing; Single media can hold many images, ease of manipulation **(Sandler and Murray, 2002).**

Advances and development in digital photography and computer software have enhanced the usefulness of photographs for quantitative linear and angular facial analysis, photographs could be easily taken from multiple angles, allow facial soft tissue dimensions to be fully assessed and evaluated, this benefit is not possible with cephalometry, digital photographs may be viewed immediately, without waiting for the film negatives to be developed, as well as modified and measured using specialized computer programs **(Payne, 2013) .**

Chapter Three

3.1 Conclusion:-

Orthodontics and other fields of dentistry should follow technological advances strictly in order to use in practice. Capturing high-quality photos is one of these practices, comprising an important topic in all fields of dentistry. In parallel, photography has become an optional subject in some universities in our country. When advantages of photos captured in the clinic are considered

1) Routine documentation is achieved

2) Photos can be used at presentation and comparison of cases,

3) It is important to compared data during long-term follow-up.

4)Standardization of records is important to obtain reliable results, and for comparison of outcomes

5) Images captured before, during, and after treatment provide legal protection when needed.

3.2 Suggestions : -

1. More research aims at improving photogrammetric techniques is still needed.

2- Conduct a study to measure the reproducibility of photos (by more than operator or more than one camera system machine).

3- Compare the importance of different diagnostic records .

4- Extend the research to include various photographic techniques.

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