

A Technique for Obtaining Intra- and Extraoral Photographs

LAWRENCE F. QUIGLEY, Jr., D.M.D., M.S.
CAROLUS M. COBB, Ph.D.
RICHARD C. WEBSTER, M.D.

Boston, Massachusetts

Instantaneous and reproducible photographic records have been the aim of countless plastic surgeons, dentists, orthodontists, and others concerned with record taking for the cleft palate patient. Just to take a picture and immediately know the results is by no means enough. For useful records the patient should be placed in a fixed relationship to the camera and reproducible conditions of illumination should be insured. The ideal record for the majority of investigators is a reproducible image of one-fourth life size which is as free of distortion as possible. Although these requirements seem modest, their practical attainment has been the goal of many workers for many years.

One of the first men to use Polaroid film for such purposes was Dr. B. Swain. In 1960 he demonstrated a camera device which was developed at the Department of Orthodontics, Fairleigh-Dickenson University. This device used an extended bellows to give four-to-one reduction at a set 30-inch object distance. Although the camera had many advantages, its specialized design placed limitations on accuracy and convenience. It could be used only for black-and-white photography.

As part of a program to obtain greater accuracy and to facilitate record taking in the average clinical office, a re-evaluation of the clinical photographic problem seemed desirable. From previous experience in making photographic records of this type, it was clear that provisions must be made for the following needs: a) a fixator for positioning the patient, b) a framing device capable of orienting the patient in the same position at different times, c) lighting of uniform intensity for both color and black-and-white film, d) easy storage and transportation of the unit, e) the use of instant processing film, f) a bifunctional mounting which permits either hand-held or fixed use of the apparatus, and g) simplicity

Dr. Quigley is Research Associate at Tufts Cleft Palate Institute, Orthodontic Consultant at Webster Clinic and Yale University, and is affiliated with Forsyth Dental Center at Harvard School of Dental Medicine, Boston. Dr. Cobb is affiliated with American Science and Engineering, Inc., Cambridge. Dr. Webster is the Director of the Webster Clinic for Plastic and Reconstructive Surgery, Brookline.

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of operation in order to permit those untrained in the complexities of photographic principles to obtain excellent results every time.

From a number of experimental trials, a camera system has been developed which meets the foregoing requirements in a satisfactory manner.

The ideal technique would be to have the subject illuminated with light parallel to the lens axis, which currently is impossible technically. In addition, the nearest approximation to such conditions, the ring light, often produces an undesirable flashback in the lens of the eye. In color photography the subject's eyes appear quite red and in black-and-white photography halos are seen around the eyes rather than around the head. The flashback in the eyes can be angled away from the camera to give satisfactory color reproduction for extraoral work by placing an electronic flashgun above the camera. Since it is necessary to introduce at least one degree of obliqueness in the position of the light source to avoid this flashback phenomenon, special precautions must be taken to eliminate other aspects of obliqueness in the lighting. To do this, the light source is placed in the midsagittal plane and as close to the lens axis as possible. This illuminates both sides of the midsagittal plane uniformly and eliminates most of the extraneous shadows. The supra-axial position of the light source does cause a slight difference in the intensity of the illumination from the forehead to the chin. The physiognomy of the face, however, is such that shadows from this position are almost nonexistent.

Hand-Held

For the hand-held camera the mounting device is very simple and is a means of rigidly attaching the framing device to the camera. Figure 1 schematically shows the shape and positioning of the mounting for intra- and extraoral procedures. Figure 2 is a photograph of the hand-held mounting device which was finally developed. Although permanently mounting the camera is much more convenient, such a method usurps more office space than many workers wish to relinquish.

Fixator

Any orthodontic cephalostat will serve as a sufficiently accurate head positioner for all routine record taking. More sophisticated positioning devices are necessary for record taking of plastic surgery patients where the photograph is to be used as a precise image from which measurements can be taken. It is doubtful if the majority of rehabilitation procedures for cleft palate patients require such rigorous exactitude. However, such a device will be described in a later publication for those few in the research or forensic fields who require accuracy within a few hundredths of a millimeter.

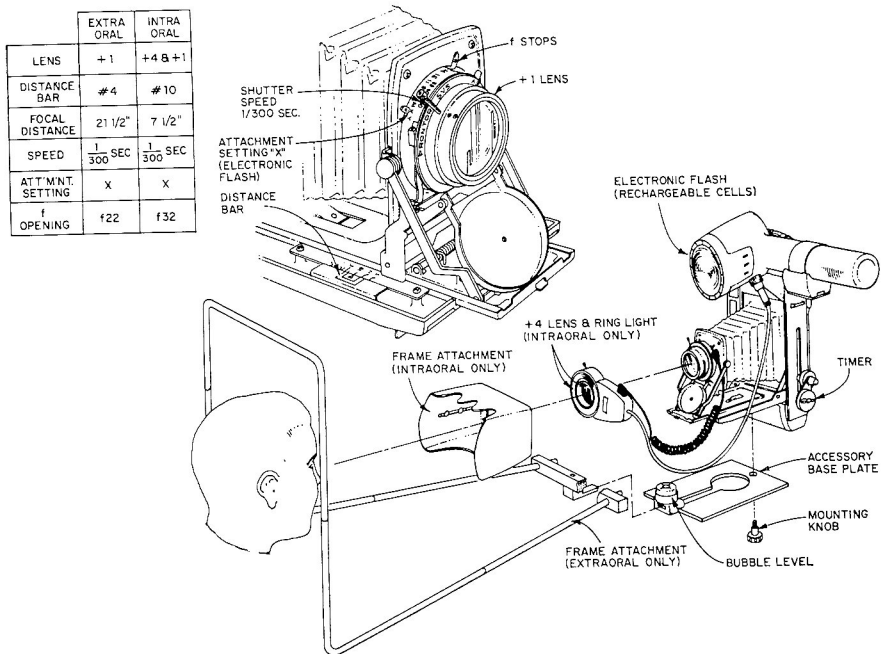


FIGURE 1. Schematic view illustrating intra- and extraoral attachments and settings.

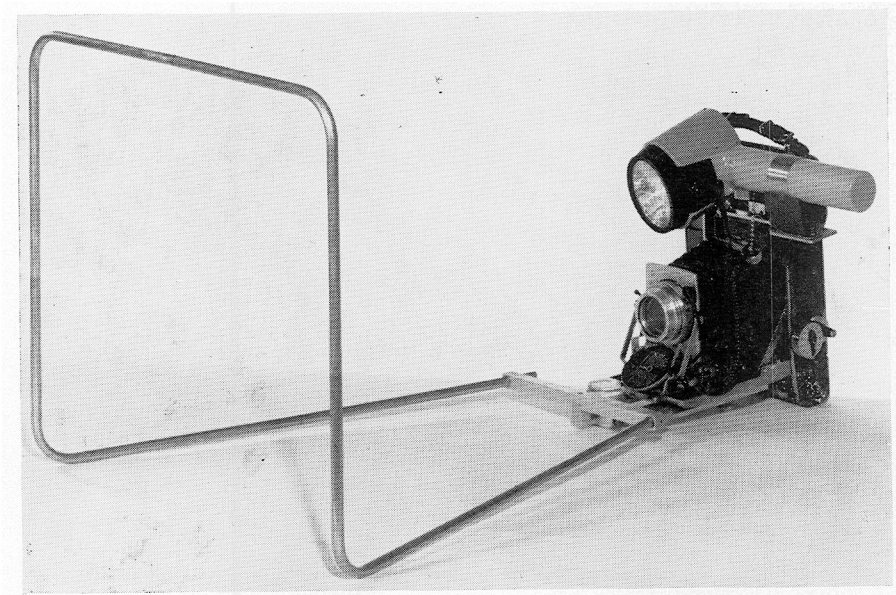


FIGURE 2. Complete camera system for reproducible, hand-held extraoral photography.

Framing Device

Several types of framing devices have been tried. For hand-held extraoral photography the most satisfactory has been a semi-rigid U-shaped device which passes over the patient's head and shoulders. Figure 1 shows a schematic illustration indicating the manner in which the framing device is used to establish the proper orientation and distance between the camera and the patient. The patient's head is held with a standard orthodontic cephalostat and the framing device is hand-held. For extraoral photography using a rigidly mounted camera, either no framing device or a much simplified version is sufficient.

When using the framing device, we place the camera so that the vertical rectangle serves as a reference plane in the front and profile views. When taking a profile view, we place it so that this plane coincides with the midsagittal plane of the patient. For front views, the vertical rectangle is positioned in a plane located one-third the distance from the tip of the nose to the tragus of the ear. It is always oriented in the center of the frame and the leveling bubble is properly centered.

Light Source

Two different types of lighting are required for successful extraoral photography: adequate back lighting and the conventional direct illumination.

Back lighting is achieved most simply and efficiently by using an opalescent or frosted glass panel lighted by fluorescent tubes. This is placed on the wall adjacent to the patient and at right angles to the axis of the camera. The numerous other methods of achieving back lighting used by professional photographers which involve oblique illumination and diffusing and absorbing screens are beyond the skill of most clinicians. These systems are designed to achieve the utmost in flexibility and require many years of practice to use satisfactorily. Not only is this lighting unnecessary, but it is also a hindrance in taking clinical pictures.

Direct lighting by an electronic strobe is most satisfactory. In medical photography oblique lighting is often used because it is convenient. For work that is free of distortion and shadow, it is seldom adequate. The angle between the light and the lens axis tends to introduce extraneous shadows so that important areas are often underexposed, producing a misleading result.

Rigid Camera Mounting

Figure 3 is a schematic drawing of a rigid camera mounting suitable for wall attachment. It was developed through the combined efforts of Professor Ernest Levitt, Tufts University Engineering Department, and the Tufts Cleft Palate Institute. The mounting arm consists of a one-inch diameter by two-foot long aluminum tube attached to a hinge axis bracket which is mounted on the wall. The mounted bracket has

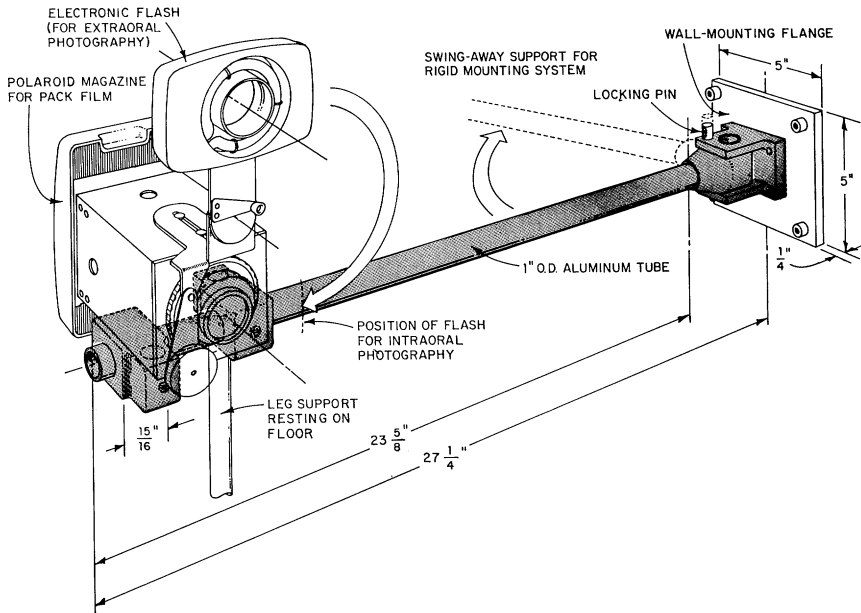


FIGURE 3. Complete camera system for wall mounted extraoral photography.

a locking pin so that the angle between the tube and the wall can be fixed at 90° . Vertical torque on the extended tube is lessened by an adjustable vertical rod which rests on the floor. The camera is positioned in an adjustable clamp at the end of the tube.

This design has proved to be exceptionally convenient since the camera may be swung out of the way when it is not in use. Other methods of rigid mounting, such as attachments to conventional chairs, have been considered and will be the subject of future publications.

Camera

The best results in instantaneous color or black-and-white clinical photography to date have been achieved using the Graflex Century camera with Polaroid film pack backing which produces an image with minimal distortion and good depth of field. Excellent results can be achieved with any Polaroid camera, although under some circumstances (front view) some distortion occurs. Any camera equipped with a Polaroid backing can be made to give satisfactory results, provided lighting and focusing are done properly.

Complete Camera Systems

The complete assembled units which gave the best results are shown in Figures 2, 3, and 5. Figures 2 and 3 show the use of the hand-held framing device and the use of the wall mounting framing device, re-

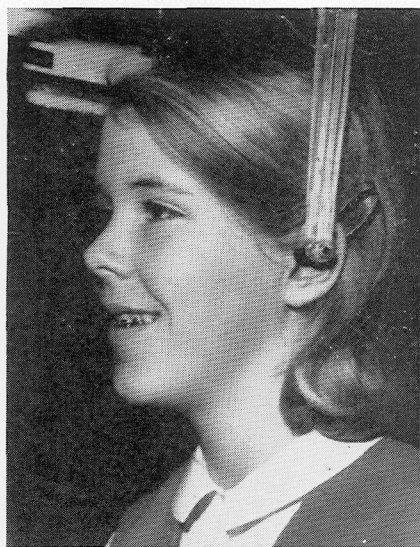


FIGURE 4A. Front and side views taken with hand-held camera system.

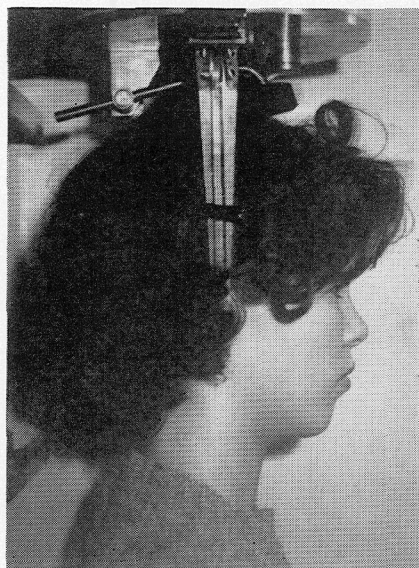


FIGURE 4B. Front and side views taken with hand-held camera system.

spectively. Frosted glass back-lighting panels are used by many workers, although some prefer black velvet backgrounds. Figures 4A and B depict front and side views taken with the hand-held camera system. The ruler can be used to verify the exact four-to-one reproduction.

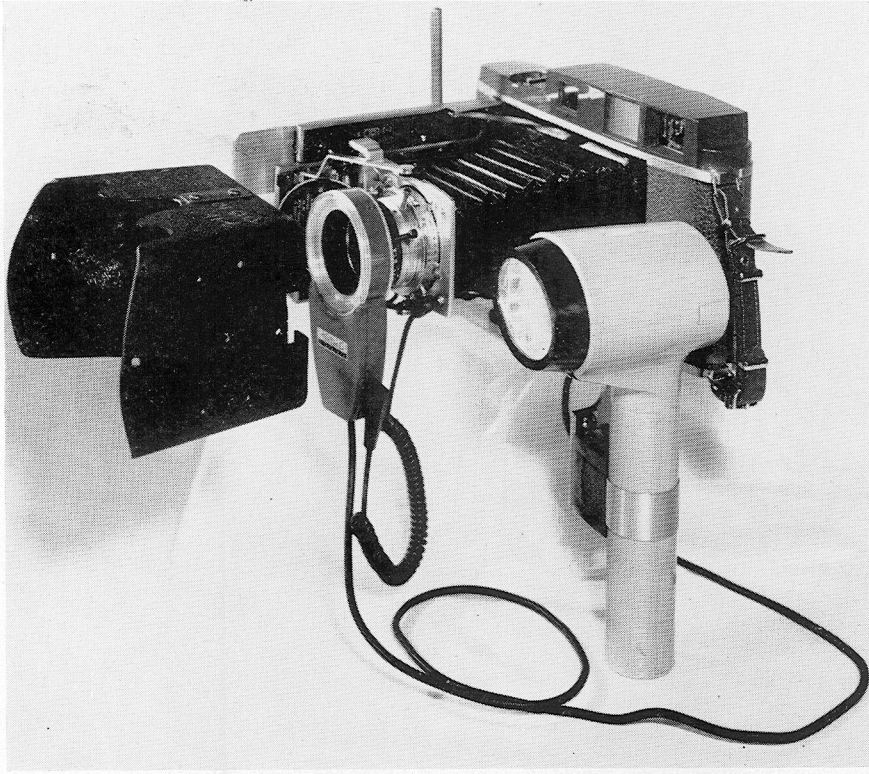


FIGURE. 5. Complete camera system for intraoral photography.

Intraoral Photography

The principles of fixed framing devices have been well established for cavity photography. The use of a ring light and the absorptive qualities of oral cavities simplify the entire problem. For most clinicians the major difficulties arise in obtaining a sharp focus on the desired field of view.

A very satisfactory solution to this problem of framing and focusing can be obtained by using a detachable frame with the focal plane of the camera at the center of the frame. This not only provides stability for hand-held intraoral photography, but in addition, because of the superposition of the focal plane and the frame, it enables the operator to correctly visualize the precise field which will be in focus.

Figure 5 depicts the use of the hand-held framing device for intraoral photography. Figure 6 shows two photographs taken with this camera system. Note the relative sharpness of focus for the primary subject in the field. Good depth of field was obtained by stopping down to F-45. Exact one-to-one reproduction was obtained in these pictures.

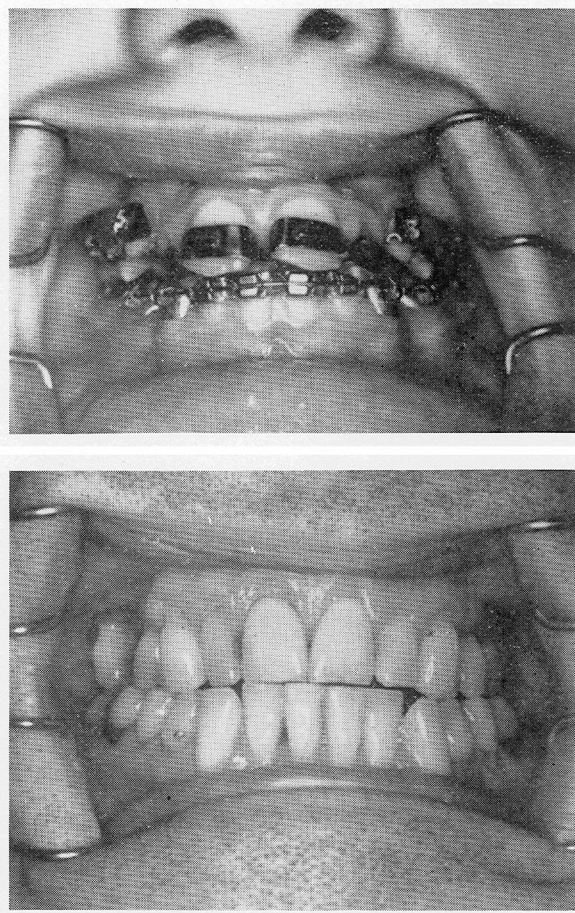


FIGURE 6. Two views taken with intraoral photography system.

Discussion

Record taking is a foundation upon which we must build the diagnosis, prognosis, and evaluation of our work. Editors of journals must look with jaundiced eyes at the articles they receive which have perfect well-balanced pre-operative photographs, but glaring 'hot spots' post-operatively. With the presently available record taking equipment and taking into account the harried life of the average clinician, these mistakes are understandable. Few medical or dental clinicians have the time or interest to become professional photographers.

This investigation has endeavored to perfect a system for intra- and extraoral photography which is accurate and simple enough to operate so that auxiliary personnel can take proper photographic records. Cost for a photographic system should be minimal by using as many standard components as possible. Although the system described here is the

result of many years of endeavor and has been found to be the most satisfactory of all those tested, substitutions for selected components are possible. For success, however, any substitutions must not violate the general principles for intra- and extraoral photography record taking.

The obvious advantage of instant photography is that the record is known to be correct before the patient is dismissed. The system described above goes beyond this to present a standardized method for reproducing pre- and post-operative records which are properly exposed with a minimum of distortion.

Summary

Cleft palate workers have been faced with the problem of obtaining adequate records at the time the patient is seen for examination. By means of instant processing film, photographic records may be evaluated immediately. The photographs may then be retaken, if necessary, without recall of the patient.

A system, primarily designed for clinical use, is described which will permit the repetition of the same view under standardized conditions at different times. Solutions to the problems of focusing, illumination, patient positioning, and framing of the fields of view are presented. Integrated record taking systems are described that will permit photographing the patient for both color and black-and-white instant processing film.

The most significant advantage of the technique is to be able to photograph the patient at intervals of weeks, months, or even years under the same standardized conditions. The method also allows this part of the record taking to be done by auxiliary personnel.

7 Rangeley Road

Winchester, Massachusetts 01890

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Resource References

- BAHN, B. E., New faces for old. *J. Amer. dent. Assoc.*, 63, 1961.
 BLISS, C. H., Three-dimensional photography in prosthodontics. *J. prosth. Dent.*, 9, 1959.
 BROTH, R. H., JR., An inexpensive method of intraoral color photography. *Dent. stud. Mag.*, 39, 1961.
 CAMPBELL, U., Photography for the general practitioner. *Quart. J. National dent. Assoc.*, 18, 1960.
 FITZPATRICK, C. P., Camera in the dental office. *Dent. Survey*, 37, 1961.
 GIBSON, H. L., Black-and-white films for dental photography. *Dent. Radiog. Photog.*, 27, 1954.
 GIBSON, H. L., Camera and lighting setups for intraoral photography. *Dent. Radiog. Photog.*, 22, 1949.
 GIBSON, H. L., Kodak flexichrome process. *Dent. Radiog. Photog.*, 23, 1950.

- GIBSON, H. L., Photographic optics for dental photography. Part I. *Dent. Radiog. Photog.*, 30, 1957.
- GIBSON, H. L., Photographic optics for dental photography. Part II. *Dent. Radiog. Photog.*, 31, 1958.
- GIBSON, H. L., Photography aids good dental practice. *Dent. Radiog. Photog.*, 32, 1959.
- GIBSON, H. L., Photography—dental practice builder. *Dent. Radiog. Photog.*, 32, 1959.
- GIBSON, H. L., Photography—dental practice builder. *Dent. stud. Mag.*, 38, 1959.
- GIBSON, H. L., The role of color in dental illustration. *Dent. Radiog. Photog.*, 34, 1961.
- GIBSON, H. L., Telephoto lenses for good perspective. *Dent. Radiog. Photog.*, 34, 1961.
- GILLINGS, B., Intraoral close-up photography. *Dent. Radiog. Photog.*, 33, 1960.
- GLUCK, H., Some advice from an expert dental photographer. *Oral Hygiene*, 43, 1953.
- HAASE, J., Before and after photography. *Dent. Radiog. Photog.*, 31, 1958.
- HEIMLICK, A. C., Dental photograph: its application to clinical orthodontics. *Angle Orthod.*, 24, 1954.
- JOEL, A. A., Dental photography with electronic flash. *New Zealand dent. J.*, 52, 1956.
- JONES, B. A., A versatile intra-oral camera assembly. *Brit. dent. J.*, 111, 1961.
- MACLACHLAN, L. E., Better duplicate transparencies. *J. prosth. Dent.*, 16, 1960.
- PRENDERGAST, E. T., Stereophotography in dental practice. *Dent. Digest*, 62, 1956.
- SAULT, J. H., Oral color photography simplified. *J. Amer. dent. Assoc.*, 43, 1951.
- SCHLACK, C. A., TAYLOR, B. L., and BRONSON, J. F., Photomicrography in color as an aid in dental caries research. *Dent. Radiog. Photog.*, 23, 1950.
- SCROETER, C., A clinical camera setup for the general practitioner. *J. prosth. Dent.*, 6, 1956.
- SLATER, E., Dental photography in practice, with special reference to colour photography and the miniature camera. *Australian dent. J.*, 2, 1957.
- SMOLIAR, S., Rapid dental photography. *N. Y. State dent. J.*, 21, 1955.
- TERKOSKI, R. B., Photograph: a hobby and a helper. *J. Amer. dent. Assoc.*, 63, 1961.
- TOPEL, P. A., A dentist and photography. *Dent. Radiog. Photog.*, 28, 1955.
- WEST, W. D., Dental photography. *Texas dent. J.*, 78, 1960.