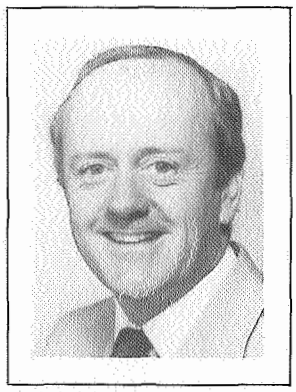
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Clinical Orthodontic Photography

Part I — Intra-oral



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Abstract:
Intra-oral photography provides depth to orthodontic case assessment and valuable visual material for patient and professional education. Photographs of excellent quality are obtained using good equipment standardized for the task and require a consistent method of setting up and execution. The article discusses requirements for good photography and lists features of photographic equipment important in producing excellent intra-oral pictures for orthodontic purposes. Correct selection of the camera body, lens and flash unit appropriate for this task is also discussed together with the auxilliary equipment necessary, such as cheek retractors and mirrors. Techniques involved in taking frontal and buccal (mirror-view) pictures are described.

Key words: intra-oral photography, photographic equipment, photographic technique

INTRODUCTION

Whilst not strictly an essential ingredient of orthodontic records, the well-taken intra-oral photograph adds depth to any case assessment. Its use can also extend to the medico-legal situation, for example, where the pre-treatment condition of teeth is in question. Some practitioners take photographs for these reasons alone.

Much educational use can be made of intra-oral photographs, which are ideally suited for lecture illustration in both patient and professional education. A well illustrated talk will have much more impact than where the visual material is substandard or non-existent. It is important therefore that careful consideration be given to setting up a photographic system which will consistently produce photographs of excellent quality. This requires a routine to be followed using a fixed system.

Certain aspects of photographic quality rely on the artistic element, particularly in framing and focussing, and it follows that unless an assistant is competent and interested in this area, a uniformly higher standard of photograph is achieved by the clinician rather than where the task is delegated. As the time involved in setting up and executing a series of three intra-oral photographs is only two or three minutes, the clinician should afford to retain control of this procedure.

It must be stressed as a cautionary note that intra-oral photographs cannot be relied upon to permit critical appraisal of clinical material. Intra-oral photographs cannot be substituted for properly mounted study models in case evaluation. "Cheating" is all too easy with such photographs and one must be suspicious where clinical material is presented relying solely on intra-oral views.

A good photograph, whether it be for orthodontic or other purposes, ***must satisfy the following criteria:***

1. Sharp definition with main subject material in focus.
2. Good depth of field.
3. Accurate colour rendition.
4. Correct illumination.
5. Good framing.

Good focus and sharp definition are obtained by using a lens of good quality. In addition, a sufficiently fast shutter speed (1/60th second or faster), steady hand and accurate through-the-lens focussing contribute to a clear, well defined picture.

Depth of field refers to the depth, or axial distance, of in-focus subject material obtained with a given setting. This is a function of the lens aperture, designated by the "f" stop. The smaller the aperture the greater the depth of field. For orthodontic purposes a lens must be able to stop down to f(22). Smaller lens openings, f(32) or f(64), cause slight blurring of the image due to the diffraction of light rays passing through a very small aperture.

Accurate colour rendition is an important aspect of clinical photography. Different films show varied tonal qualities. Kodachrome 25 (colour transparencies) is preferred by the author for its realistic colour rendition. This film's slow speed and small grain size yield high definition. Colour perception, however, is largely subjective and film choice depends on personal preference.

Illumination is provided by an electronic flash synchronized to the shutter mechanism. If the light source is mounted close to the front of the lens and travels back and forward with the lens, differences in subject/film distances are accommodated for, and no aperture variation is required within the intra oral range. A ring-flash is attached in this way. Brackets are also available for conventional flash units to be mounted similarly. It is contended that a "glancing" blow of light will give very slight shadows and thus a more textured and interesting picture than a "shotgun blast" of light which a ring flash emits. The ring-flash obliterates all shadows and results in a "flatter", less textured picture. Hence the recommendation is for a point source of light, bracket mounted such that it can be rotated to various positions as required.

Picture composition, or framing, is the photographer's organization of the subject material as seen through the view finder. It is important that the intended view be well centred, level and free from peripheral distraction, such as an excess of lips or cheeks, retractors, fingers or nostrils. The lens should be capable of focussing sufficiently close to the subject so that the above items are not included in the view. *(Figure 1)*

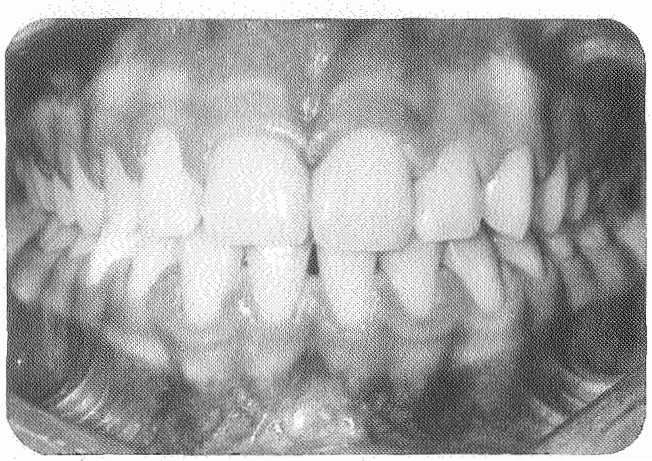


Figure 1. Frontal view — Teeth in occlusion. Note minimal peripheral distraction

Similarly, a photograph taken using a mirror should include no more than a section of the edge of the mirror. *(Figure 2)*

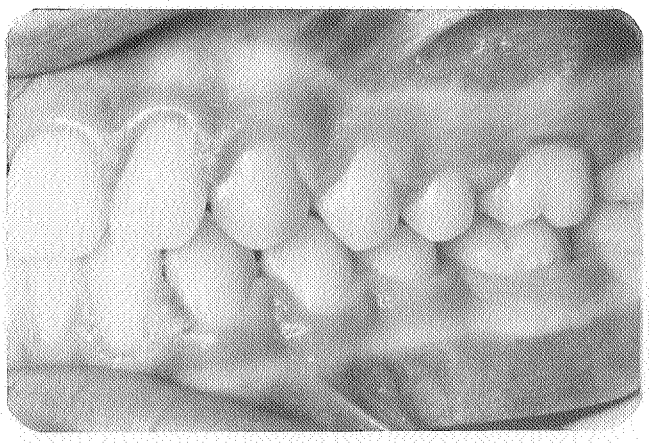


Figure 2. Buccal mirror view (Right side). Note minimal section of mirror edge visible

SELECTION OF EQUIPMENT

Camera Body

The camera body must be of the 35mm single lens reflex type. The 35mm format is appropriate for clinical use as it yields a rectangular picture, more useful for our purposes than a square negative. In addition, the actual size of the film is sufficiently large to permit good definition and high resolution, which is particularly important if projection of photographs is intended. The single lens reflex camera permits through the lens viewing, essential for accurate framing and focussing at the close range encountered in intra-oral photography. The camera body must be compatible with the automatic stop down mechanism in the lens, which will be discussed later.

The flash shutter speed setting should be 1/60th or 1/125th of a second. The overall feel of the camera body, in particular the shutter release system, must be comfortable. Most current 35mm camera bodies include the above features as standard equipment. Many have considerably more, for instance automatic aperture, speed and focus control, and although these are not necessary for clinical purpose, they can be useful if the camera is to be doubled for general use. A "pistol grip" with cable release system is often used with good results and is usually necessary where the lens incorporates a bellows.

Lens

The ideal focal length for an intra-oral lens is 100mm but can range from 95mm to 125mm. This focal length yields good perspective and allows the camera position to be comfortably distant from the subject: far enough to permit the use of a side-mounted point source of light. A 50mm lens, on the other hand, has to be positioned closer to the subject for correct framing and focussing. In this situation a side mounted flash unit will cause shadows of the lips to fall across the field of view. Hence for the 50mm lens, a ring-flash, with its "shotgun" lighting must be used.

The lens must have aperture control stopping down to f(22) allowing maximum depth of field. The lens must also have an automatic stop down mechanism. Framing and focussing is done at the widest aperture, thus allowing maximum light during preparation. The diaphragm closes down to the pre-selected stop the instant before the shutter opens.

The lens must be able to focus at close range so that full life size magnification is achieved on the film. In clinical terms, this is equivalent to three or four incisor teeth filling the frame. This is achieved using either an extension bellows or a macro lens.

A bellows connects the camera body to the lens which when wound forward on its track increases the lens to film distance and hence the magnification.

A more recent development to achieve the same magnification has been the "Macro" lens. Its construction is basically the same as the standard lens except that it can be focussed much closer to the object. Most macro lenses require the placement of a life-size adaptor to permit full life size magnification. This is an extension tube coupled with the lens so that the automatic stop down mechanism can function. With the adaptor in position the working range of the camera is between half life size and full life size. This is the appropriate range for intra-oral photography.

Both arrangements, bellows or macro lens, take equally good pictures, so the choice is one of personal preference. The advantage of the macro lens is that it is more robust and can be safely used outside the surgery. Its main disadvantage is its weight and the necessity for the adaptor ring to achieve full magnification.
Figure 3 shows the Minolta SRT 101B Body and 100mm Macro Rokker Lens (1:3.5).

Flash Unit

The flash source should give dependable, consistent illumination for clinical photography. As described earlier



Figure 3. Camera Body and Lens

a point-source of light is suitable and even desirable for our purposes and the flash unit can be simple and compact. However, it must be sufficiently bright so that adequate illumination is available at the small f(22) aperture. If a flash unit over-illuminates, it can be baffled down using cotton gauze taped over the light source. *Figure 4* shows the author's flash unit — a Soltron 133c powered by 4 x "AA" batteries. This unit has an automatic setting which is not appropriate for clinical use as it requires the use of a wider aperture setting than f(22).

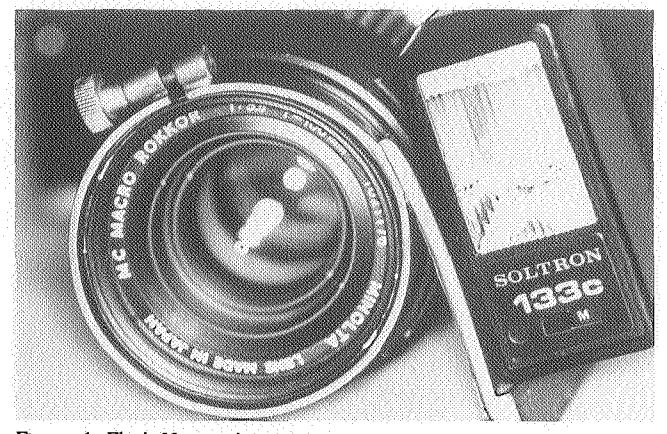


Figure 4. Flash Unit and mount

Flash Mount

The flash unit must be mounted near the front of the lens to move with the lens. It must also be angled towards the lens axis and the mounting must permit the flash to be moved around the lens. The flash mounting, constructed of brass and acrylic material, was specially engineered for the purpose. The circular rim has an inner flange fitting into a groove cut into the outside of a filter ring attached to the lens *(Figure 5)*. The mount can be moved through 360 degrees and locked into any position around the lens. Although this particular mount is relatively heavy, lighter mounts are available commercially.

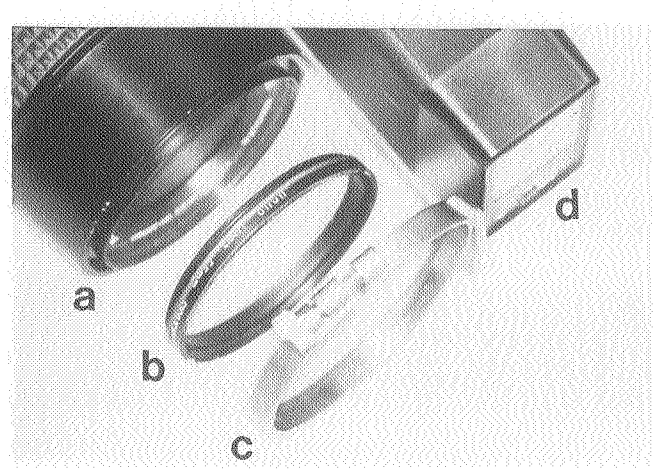


Figure 5. Flash Mount Assembly — disarticulated(a) lens(b) filter ring — grooved (c) flash unit mount (d) flash unit

Retractors

Lip retractors for photographic purposes should be clear plastic to minimize distraction and have adequate depth for good lip purchase. The use of two sizes of retractors should accommodate all mouths. Retractors can be easily modified giving a wide range to cover most situations. For the mirror shot technique described below, a wide ended Hu Friedy wire cheek retractor is necessary *(Figure 6)*.

Mirrors

Mirrors are necessary for buccal and occlusal views. Mirrors should be of high reflective quality and be front-surface reflecting. Suitable mirrors are made by Evaporated Metal Films*. The "University of Washington" set comprises one buccal mirror and two occlusal mirrors, child and adult size. These cover most clinical needs. The mirrors are double sided, rhodium-plated, front surface reflecting and of excellent reflective quality *(Figure 7)*.

*Evaporated Metal Films, Spencer Road, Ithaca, New York

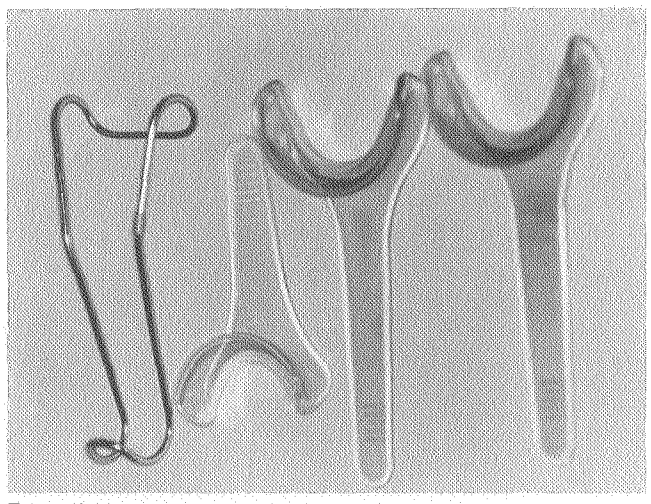


Figure 6. Lip Retractors

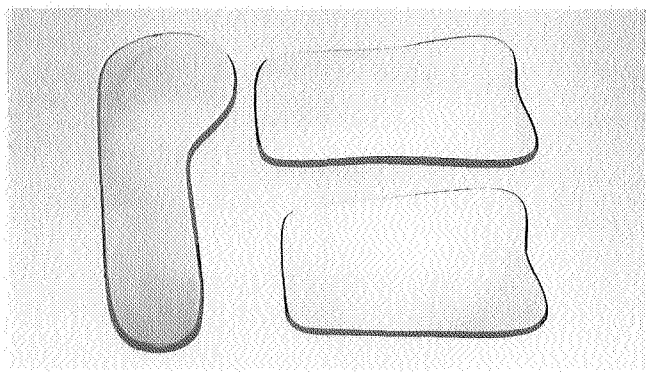


Figure 7. Mirrors: "University of Washington" set

TECHNIQUE

For intra-oral photographs the patient should be seated comfortably and upright in the dental chair. The height of the chair should be adjusted to suit the clinician who may be seated or standing. The camera settings should be fixed as far as possible for efficiency and consistency. The shutter speed, ASA and aperture settings can be taped to ensure against accidental movement. A standard set of intra-oral photographs comprises three views: a frontal view and left and right buccal views, all taken with teeth in occlusion. The buccal views are taken using a mirror.

Frontal View

The appropriate cheek retractors are placed in each side of the mouth and held from behind by an assistant. The correct size retractor will give optimal lip retraction at the same time allowing the patient to bite together in centric occlusion. The handles should be held away from the cheeks to prevent the inner cheeks collapsing on the buccal segments *(Figure 8)*. The surgical light should be directed on to the teeth for all intra-oral photographs to assist in focussing. The extra illumination on the field will not adversely affect the picture as the flash is more intense and overrides the surgical light.

Framing and focussing should be done in the same procedure. The focus setting is adjusted for the average sized mouth. For a 100mm macro lens the ring is set at 240mm subject to lens distance giving 0.6x magnification.

The camera is positioned and aimed so that the subject is well centred and fills the field of vision without peripheral distraction. If, at a position where the subject is

in focus, the framing is not correct, a small adjustment of the focussing ring will be necessary. To achieve the maximum amount of sharply defined subject, focussing should be centred on the canine or first premolar. The camera must be steadily supported during this procedure and the shutter is released at this point. Maintaining the hand-held camera stock still is difficult, however releasing the shutter during a small "forward press" is an effective way to avoid unnecessary movement.

Buccal Views (left and right)

The buccal views are taken using a small plastic cheek retractor, the Hu Friedy wire retractor and a buccal mirror. The plastic retractor is placed on the side of the mouth opposite from that to be photographed. The patient is instructed to lightly hold the handle. This retractor prevents the lips from collapsing over the anterior teeth. The wide end of the Hu Friedy retractor is placed on the object side and the patient is instructed to turn his head towards that side for ease of camera aiming.

The buccal mirror, which must be warmed to avoid fogging, is placed through the end of the Hu Friedy retractor with the narrow end reaching as far distally as possible and angled away from the teeth allowing a clear view of the buccal segment through the mirror. The assistant holding the Hu Friedy now supports the mirror in position with her free hand *(Figure 9)*. This can be uncomfortable for the patient and reassurance is often necessary.

The patient is now ready for the photograph. The lens is wound forward for greater magnification. The view should be framed such that the edge and distal end of the mirror borders the photograph in one or two places. The camera is aimed at the premolar area with the occlusal plane centred and level. Focussing is again done by moving the camera towards or away from the target. The shutter is released during a small "forward press". When the opposite side is photographed, the flash unit must be moved around to the other side of the lens, otherwise a large shadow will be cast across the field. Rotating the flash unit and re-warming the mirror is done whilst the assistant is reversing the positions of the retractors.

Occlusal Views

Occlusal photographs are useful in certain instances such as palatally impacted cuspids, but are generally not regarded as part of a routine set of photographs. They are best taken using mirrors and the same techniques employed as for the buccal views.

(Part II (Extra-oral Photography) will be published in a subsequent issue).

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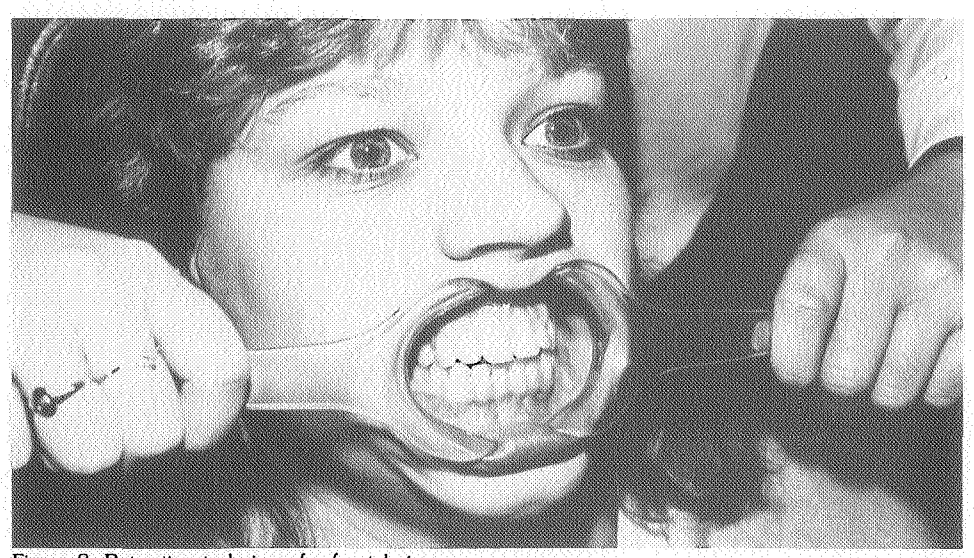


Figure 8. Retraction technique for frontal view

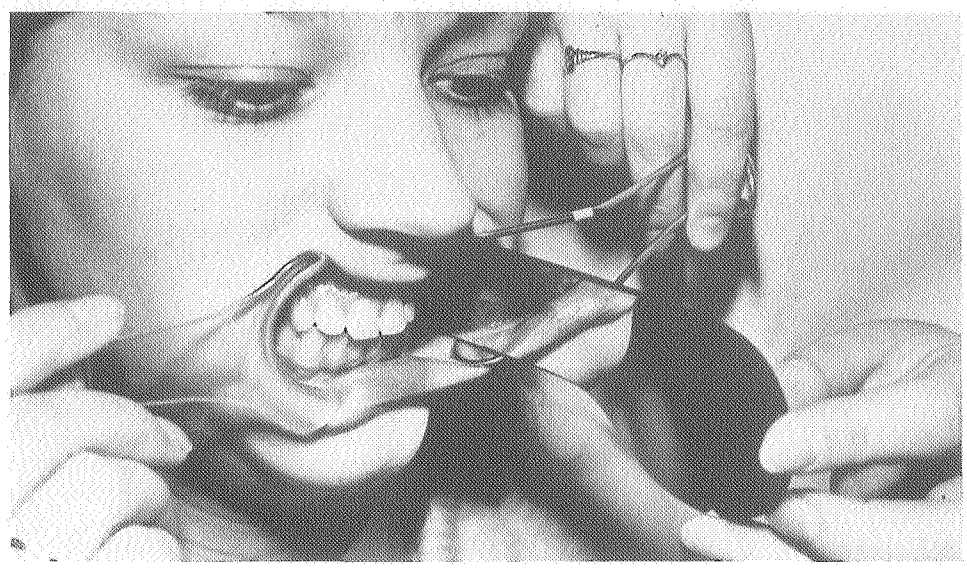


Figure 9. Retraction technique for buccal mirror view