W26

The Technique Necessary for Making Good Dental Skiagraphs.

By Weston A. Price, D.D.S., M.E.

The procedure for making good dental skiagraphs is not much more exacting and difficult than many of the everyday operations of both the dentist and surgeon. There are doubtless other methods of obtaining excellent results that may be quite as good, but I shall give as briefly as possible the technique which I use.

The Generator. We must use a relatively high penetration and a large volume. The high penetration is essential because our contrasts are to be secured between all dense substances, bone and more dense bone, or tooth substance and root fillings, whereas in ordinary skiagraphy the contrasts are chiefly between flesh and bone. The large volume is essential in order to make short exposures which are necessary to secure the best definition. The two qualities of high penetration and large volume make it necessary that we have a very powerful generator for which I prefer a large coil and the Wehnelt interrupter.

It is very desirable that the apparatus be so conveniently arranged that the patient may be seated in the dental chair which allows of a wide range of positions with comfort to the patient and firmness and steadiness of the head not easily secured in any ordinary chair. The difference in

Reprint from Items of Interest.

the results is about the difference between the photographic work of the man who holds his camera in his hand to make a bulb exposure and the man who sets up his tripod. It is a question of showing with exactness of definition and detail either the cellular structure of the bone and sharply defined alveolar walls or simply a blurred indefinite outline of the structures.

The switch for turning on the current should be very conveniently arranged so that the operator can easily turn on and off the current while holding the film in position. In some cases I find that the patient can hold the film satisfactorily, but in most cases I can get better results if I hold it myself.

The Tube. The selection of the tube is, if possible, more exacting than the generator. As stated before, the conditions we are skiagraphing and the information we desire are such as to require a tube giving a relatively high penetration. Of course the penetration of tubes is not in constant proportion to the spark gap they will back up, though quite regularly so with tubes exhausted from the same gases. For the dental work we require a tube of a penetration sufficient to make the bones of the hand look quite white and transparent, which will back up from a four to an eight-inch spark this soft tissue gap. Most of the failures in dental work have come from using too low a penetration. When locating abscesses to produce a clear definition generally use a little lower penetration than for locating root fillings or broaches or even impacted teeth, and all of these will be modified a little to advantage for older or young patients, using a little higher penetration for old patients. The quality of a high penetration tube is quite easily secured if you select the tube yourself from a number, which I generally do, or it can be entrusted to a good dealer whom you carefully instruct. These high penetration tubes, or so-called hard tubes, can often be secured from operators who do general X-ray work for which they desire the medium and lower penetration, the tendency of tubes in use being to get higher.

But tubes for this work must have another important quality which is much more difficult to obtain, and that is being capable of carrying a very large current without overheating the anti-cathode or materially lowering the vacuum of the tube. The ordinary tubes with a thin or medium thick sheet of platinum anti-cathode are not satisfactory for the best results in dental work because they will not stand this large volume. We should use a tube with some device for absorbing the heat from the platinum which may be either those backed with a heavy mass of metal or those water cooled. It need not be a circulating stream of water but a reservoir of it in a special receptacle around the base of the anti-cathode.

Some may ask why not be content with using a tube giving smaller volume of X-rays and give a longer exposure? Because we cannot get the best definition showing the cellular structure of the bones except by avoiding the slight distortion due to the unavoidable movement of the parts during a longer exposure from breathing, etc. A very slight movement of the patient is equivalent to a considerable movement of the tube and is sufficient to destroy the fine definition of the cellular structure of the bone. I prefer a volume such as will skiagraph the hand in half a second.

The tube stand must be such as will allow of any easy and wide variation of positions and be free from vibrations.

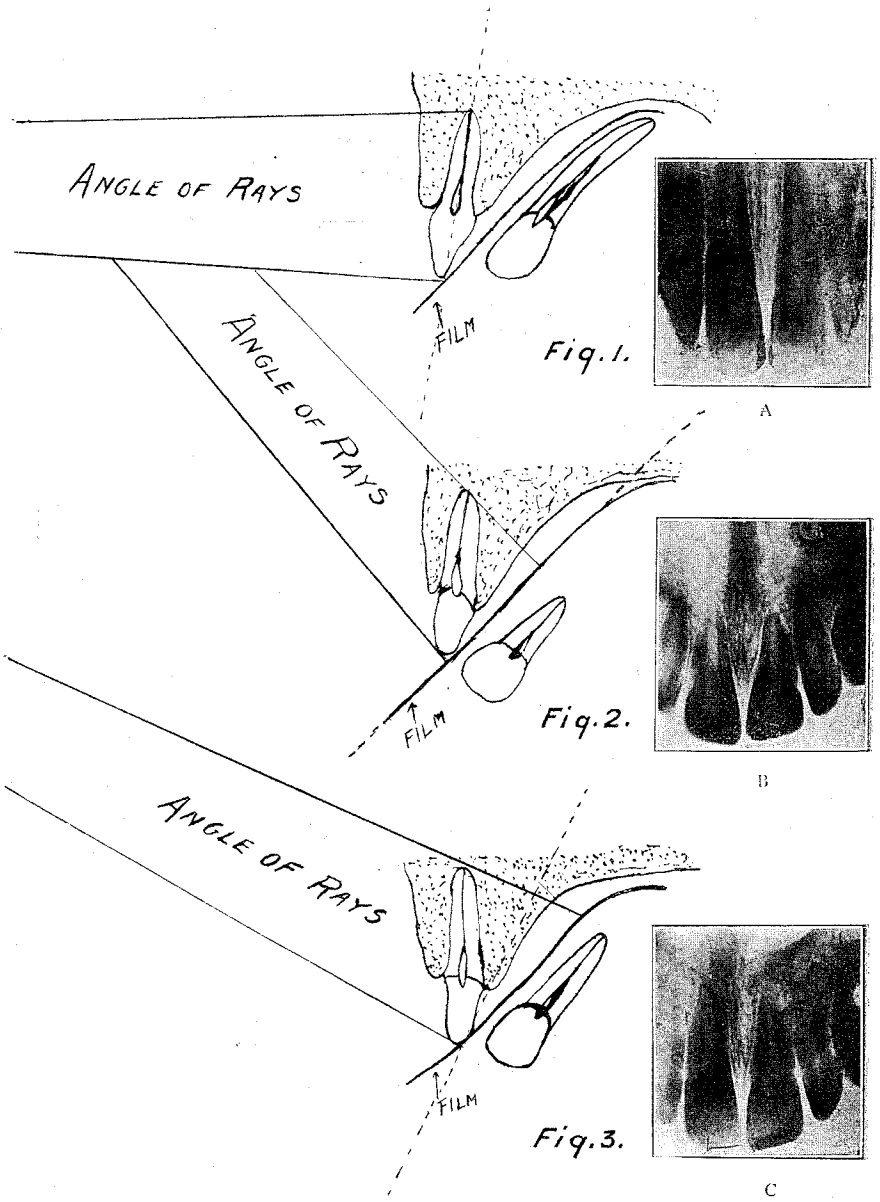
The Photographic Film. The difference in the densities of the dental structures between which we must produce photographic contrasts is so slight that it makes it practically impossible to get choice results with ordinary photographic film. We must pile up the light contrast by using several layers of emulsion on the same film. Nearly four years ago I put a great deal of work on the production of such a film which has given excellent success and I believe is in general use for this work and is being manufactured by the M. A. Seed Dry Plate Co., of St. Louis. It has three layers of emulsion one upon the other and all are acted upon at once by the X-rays. It can be secured from them direct by specifying by my name or by asking for the special dental film. The celluloid is thick enough to prevent curling and yet sufficiently flexible for the purpose and is selected from specially prepared smooth polished stock free from scratches. The conditions under which we use it require it to be covered with a waterproof, light-proof flexible container, and for this purpose I have found nothing so satisfactory and convenient as the unvulcanized black dental rubber, which can be secured at any dental supply house. Buy the thin, made by Dougherty. For two reasons I put in a sheet of sensitive bromide paper, with its face to that of the film to protect the emulsion of the film from the action of the sulphur of the rubber and to give me a positive of the case within one or two minutes which may yield the information desired and will show accurately whether the negative covers the area desired, and if the exposure will be right. These dental films are made up quickly by placing a sheet of a 4 x 5 or 5 x 7 sensitive bromide paper on a sheet of film the same size, face to face, and then taking the paraffined linen from one side of the rubber and touching the edges of the sheets together. Use three sheets for a 4 x 5. They will stick very tenaciously; then folding this over the film and bromide paper press the edges together to seal them in. Mark a 4 x 5 into nine small divisions varying a little in size and cut through with shears and fold the rubber from the film side over the edge

to touch the rubber of the other side where it will adhere tightly. Snip the sharp corners off the film and fold the rubber over them. These films will keep in good condition for weeks until needed. To keep them from sticking place them in a piece of the paraffined linen taken from the rubber. When making the exposure I place a small number (made from fine lead fuse wire and the figures stuck onto a piece of heavy paper with mucilage) against the rubber where it will stick. This number is recorded with the record of the case and appears not only on the negative but on all prints made from it. This is most important in dental skiagraphs which are so similar in general, and a quantity of them soon accumulates. As the film is extremely sensitive to daylight as well as to the X-ray, it is exceedingly important to take the greatest care that it be kept in a lead box and not in a hot place, and when preparing use the most subdued ruby light. This is very essential.

The Exposure. For making the exposure I prefer the patient to be in the dental chair because of the ease in adjustment of the patient and rigid support for the head. Much skill is required to place the film and tube in the proper relations to the teeth to produce a correct shadow of the parts without distortion. We all know how seldom our own shadows represent our true height or shape because the source of the light and the surface receiving the shadow are not in the proper relation to the object casting the shadow. Each of these three factors must be in correct relation to the other two, but one of them, the teeth and surrounding structure casting the shadow, are by their peculiar position practically fixed and the others must therefore be adjusted to them. The shape of the arch prevents one placing the film in the best position to receive the shadow, viz.: in parallel planes. This produces a distortion which must be overcome by placing the source of the light in just the position that will shorten the shadow just the extent that will correct the elongation of it produced by the film not being in a parallel plane to the roots of the teeth. We do not have this trouble with the lower bicuspids and molars, but we do with the lower cuspids and incisors and with all the upper teeth.

The correct image can be secured in two ways, by holding the film away from the crowns of the teeth the same distance that it is away from the roots or by raising the source of the rays. The former is more difficult and the results not more satisfactory. The three diagrams, Figs. 1, 2 and 3, will illustrate this distortion and how to correct it. No. 1 shows diagramatically the relation of the tooth and the film to each other and the result of taking a skiagraph with the tube opposite and at right angles

to the plane of the teeth and shows the distortion by elongating the shadow of the root. The skiagraph A. opposite was made with the tube in this



position and you will notice the very long roots, nearly twice the correct length. Fig. 2 shows the distortion by placing the tube so that the rays

fall at right angles to the plane of the film, thus greatly shortening the shadow of the roots, and the skiagraph B. opposite shows the same teeth as A., but taken with this position of the tube. The next, Fig. 3, shows the correct position for the tube in order to produce a shadow of the teeth that will have the minimum of distortion, and the skiagraph C. opposite shows the same teeth as A. and B. taken from this position, and you will note easily the difference in the results. This correct position of the tube is easily ascertained in two ways. It is just half way between the two

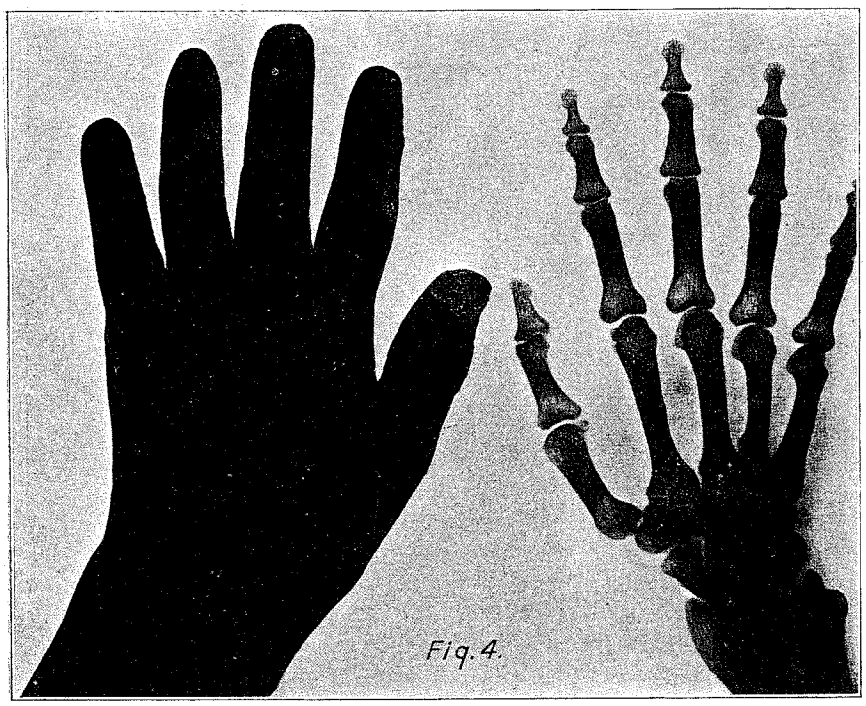


Fig. 4.

positions which are at right angles to the long axis of the teeth and to the film. This position is also at right angles to a plane half way between that of the long axis of the teeth and of the film. This simple rule holds for all teeth and for any shape of arch except that care must be taken not to curve or bow the film unnecessarily. There are a few positions, like the lower anterior incisors and cuspids where it is easier sometimes to place the film in a plane parallel to that of the teeth and place the tube at right angles to both, then to adjust as above. Occasionally it is difficult to place the film for impacted lower third molars owing to the sensitiveness of the fauces. Dr. Dwight M. Clapp suggests using a mouth mirror frame to

hold the film. I believe this is a good idea, though I have never had a case where I could not hold it quite comfortably with my finger.

Protection for the Hands from the X-Rays.

About a year ago I feared I would have to give up the use of the Roentgen Rays for a time, because my hands were getting so sensitive to irritation from it, but I was fortunately able to correct the difficulty very satisfactorily. I devised an opaque cloth and an opaque rubber sheeting and opaque rubber gloves that have quite perfectly relieved the trouble. My hands do not trouble me in the least since using this protection. The effect of the X-rays being accumulative, the operator is in a hundredfold more danger than the patient when making dental skiagraphs. I have never had a sign of irritation of any kind on any patient from making dental skiagraphs. To protect my hand from the X-rays when holding the film I place a piece of the opaque rubber sheeting over it just before turning on the current, and I use a shield over the tube made of the same material for part of my work. When experimenting or working around the tube the gloves are a perfect protection. This skiagraph, Fig. 4, shows one hand with the glove on and the other off.

Special Development.

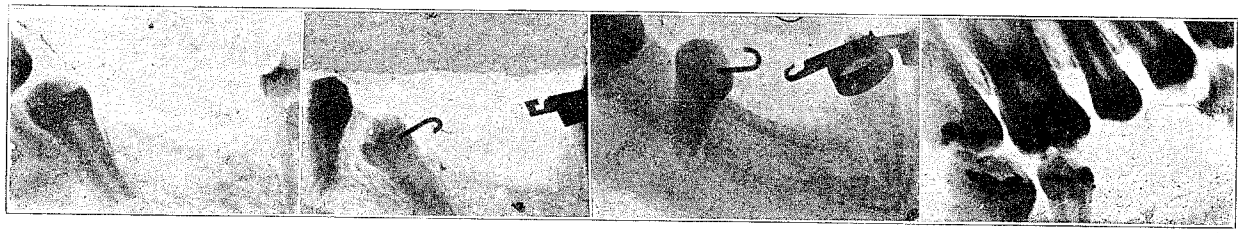
This triple coated film requires special development. In order to secure the contrast of all three layers of the emulsion without fogging the upper one it is necessary to have the temperature and strength of the developer very carefully adjusted, about 75° in the winter and 70° in the summer, and the development must be slow enough to allow the lower layer of emulsion to be acted upon before the upper one is over developed. Since our picture is purely a shadow I develop for strong contrasts, producing dense negatives and take from 20 to 40 minutes for development. I prefer a Metol-Hydroquinone developer because with the necessary slow development it is very free from stain. There is a tendency for a lustrous, thin metallic deposit of silver to be deposited on the surface of the film after long development, which, if not removed, will very greatly impair the printing qualities of the negatives. It can be quite readily removed by rubbing with a tuft or ball of cotton. The bromide paper will develop in from half a minute to two minutes in the same developer, but must have a special fixer, or use the velox fixer. The film should fix for at least thirty minutes and the negative should not be held in the strong light of an electric or mantle gas light until dry. The image will not appear distinctly on the back when developing. Care should be taken to wash the film in running water for five minutes between the developer and fixer. I use the following developing and fixing formulae:



Fig. 5.



Fig. 6.



A B Fig. 7. C D

METOL-HYDRO DEVELOPER.

A.		B.	
Water	16 oz.	Water	16 oz.
Metol	30 gr.	Potassium bromide	15 gr.
Hydroquinone	30 gr.	Sodium carbonate (dry)	130 gr.
Sodium sulphite (dry)	130 gr.		

If the crystalized sulphite and carbonate are used take twice as much as the formula calls for. To develop take equals parts of A. and B. The developer should not be lower than 75° F. in winter and not higher than 70° F. in summer.

FIXING BATH.

A.		B.	
Water	96 oz.	Water	32 oz.
Hypo	2 lbs.	Chrome alum	2 oz.
Sulphite of soda (crystals)	4 oz.	Sulphuric acid	¼ oz.

After they are thoroughly dissolved, pour A. into B. while stirring A. rapidly. As the Chrome alum dissolves slowly, a stock solution of B. can be made up. This fixer may be used repeatedly.



A B Fig. 8. C D

I will show a few lantern slides illustrating the information that may be secured and bring out some details of method as they are shown.

Fig. 5 shows a collection of diseased roots, the first two with extensive absorption, and the last two with extensive deposits on the roots.

Fig. 6 shows the right and left cuspid and bicuspid region of both upper and lower jaws of a boy 12 years old. The temporary cuspids and molars are all in place and it is a problem whether their successors will ever erupt. The skiagraphs show a strange condition. The cuspids are all forming but only half of the bicuspids. Only one of the four right bicuspids has formed.

Fig. 7 shows the finding and the steps of correction of a strayed lower bicuspid. A. shows this second bicuspid more than an inch from its proper position and on its side. The gum line is dotted in. B. shows the anchorages to draw it up into position, and C. shows it tipped up to its proper direction. D. shows its articulation which has since improved.

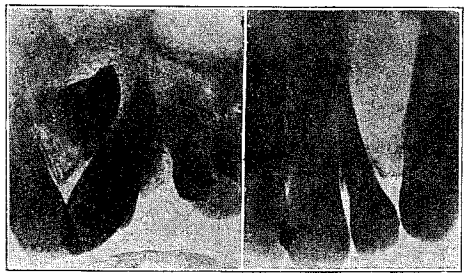
Fig. 8. A. shows the location of the unerupted cuspid and its relation to the temporary marked T. B. shows the same after some space had been secured and an opening made to the tooth. C. shows the first anchorage; it is too near to the neck of this tooth, and D. shows that the last anchorage pit is in the crown in good position. It will not be long now before it will not require the X-rays to see the tooth.



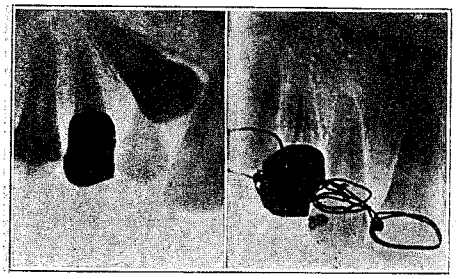
A Fig. 9. B



Fig. 10.



A Fig. 11. B



A Fig. 12. B



A Fig. 13. B

Fig. 9 shows two very interesting lower third molars. A. shows a third molar impacted against the second molar and causing a great deal of severe neuralgia by the impingement of the roots of the third molar as they are developing backward against the inferior dental nerve, the canal

of which is shown. B. shows a remarkable condition. The patient had a fistula on his face near the corner of the jaw, the cause of which could not be determined by his physicians. The skiagraph shows an imbedded third molar which has extensive decay and is abscessed at the end of its roots, from which abscess the external fistula came.

Fig. 10 shows the condition of a girl, age 14, where both the permanent laterals and cuspids were missing. The laterals have never formed and the cuspids have developed forward and are lying over the centrals.

Fig. 11 shows two cases of tumor. A. was thought to be an osteoma but proved to be a supernumerary developing between the cuspid and lateral. Case B. was thought to be a supernumerary tooth developing over the cuspid and lateral, but proves not to contain a tooth but is a sarcoma. Note how the roots of the cuspid and lateral are pushed apart and the bone is less opaque.

Fig. 11. A. shows a missing cuspid imbedded in the bone and the same tooth after being regulated to position where it was being held with platinum wire when this picture AB. was taken.

Fig. 12 shows what was probably the first skiagraph made in this country with a Radium compound, and probably the first in the world of the teeth. I made it May 6, 1900. A. shows the skiagraph of the teeth made with the radium compound, and B. shows the skiagraph of the same teeth made with the X-rays. You will notice marked difference in penetration of the two kinds of rays.