

DEPARTMENT OF DENTAL AND ORAL RADIOGRAPHY

PRACTICAL RADIOGRAPHY FOR THE ORTHODONTIST*

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GENERAL CONSIDERATIONS

IT would seem that the field of radiography in orthodontics has been quite well covered by many able writers. In fact, it seems superfluous for anyone to stand before such a group of eminent specialists merely to reiterate x-ray facts familiar to all.

At one time it seemed as though the x-ray was to play a minor role in orthodontics—that the x-ray was merely to vividly portray in a tangible manner the presence or absence of certain teeth. This is simplicity itself. One has only to place a film upon one side of the suspicious area and focus an x-ray tube upon the other side toward the film.

But just as orthodontics has stepped forward and beyond the mere straightening of teeth, so we may rightfully expect that the x-ray is capable of helping much more than was at first anticipated.

We have seen the x-ray develop from the locator of bullets and the critic of fractures to a diagnostic factor in many branches of internal medicine. It even becomes a therapeutic guide in the analysis of thoracic and abdominal pathology. The x-ray has swooped down upon general operative dentistry and taken a hold that is warranted by the increased skill which it demands of the dental operator. Formerly the surgeon probed for bullets just as the dentist probed tooth canals. The surgeon failed to locate the bullet and at the same time increased the mischief of infection in his wound. Just so the dentist probed, broached, and worked blindly, only to stop in despair and close up a tooth without adequate attention to the mischief remaining sealed in and about the apices.

The modern surgeon consents to let the innocent x-ray become his probe and locator, and the modern dentist is adding the x-ray machine to his dental equipment. The orthodontist requires the x-ray for more reasons than that it is an excellent locator of hidden problems. He uses it as a critic and guide for the delicate mechanical forces he employs to correct deformities. He uses the x-ray to reassure himself of the innocent damage which his appliances inflict upon the tissues about the harnessed tooth and upon the integrity of the tooth

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itself. What does it profit the orthodontist to correct a deformity if he unconsciously inflicts an apical infection of potential danger to the patient?

Recently we all have seen the mechanical prowess of American dentistry suffer a certain amount of chagrin and lay itself liable to a charge of gross negligence and wanton disregard of the principles of surgical sepsis. It is well the orthodontists are mindful of the potential possibilities of infection about teeth which are moved from a habitat of choice to one of efficiency. We are all familiar with the psychology of freedom and efficiency. Freedom makes stalwart native strength, while efficiency requires constant supervision or the efficiency will be undermined. Just so the tooth, which is allowed to follow its own decrees of location, will be surrounded by good stout tissues; but as soon as you forcibly, even daintily, alter the location of the tooth you find it necessary to nurture the tissues about and provide ample support for maintaining the new position. We must always fertilize ground which is bearing a strange crop.

Perhaps this philosophic rambling may seem strange, but my idea is to emphasize the fact that the x-ray will serve you well as a source of information regarding the behavior of the tissues about the teeth. When one has familiarized himself with the normal appearances of the bone texture about roots of teeth, he is then able to read the textural changes upon x-ray films of areas where teeth are being shifted. For the x-ray shadows are merely records of density and show the projected histology or pathology. In the interpretation of all x-ray images it must be remembered that we obtain a projection of the textural densities upon emulsions and the analysis of these shadows depends largely upon our knowledge of histologic and pathologic tissue. For instance, caries of a crown just below the visual gum margin is recorded as an area of increased radiability or rarefaction because caries means a loss of the dense enamel which is normally opaque to the x-ray. Again, a granulation charge about the apex of a tooth root means a liquefaction or absence of lime salts now occupied by the granuloma and therefore this periapical area is rarefied, less opaque, and shows no textural lines of normal mandibular bone.

There is a wonderful opportunity for some brilliant literature upon projected mandibular densities as revealed by the x-ray. I venture to show you a set of slides which are reproductions from a monograph by Symington. These show the progressive character of the increase in densities and delineation in texture through childhood and adolescence in a most graphic manner. We must all familiarize ourselves with these shadow values of the projected bony texture upon x-ray emulsions. X-ray films must secure an analytical interpretation or they will be considered to reveal that which they do not reveal. One must not interpret a granuloma because it looks like the granuloma shadow which was seen upon another film. The varying contrast of exposed films forces the analytical interpretation of each case and always in the light of the clinical findings of the individual case.

PRACTICAL RADIOGRAPHIC TECHNIC

There are several points which may be worthy of review for this audience. They are not new. It is only because most of us get into the habit of doing things in the easiest way that we sometimes disregard a better way.

I desire therefore to briefly discuss these points:

1. Identification of films
 - (a) by case
 - (b) for position.
2. Methods of holding films in position.
3. Charts for exposure position.
4. Visualization of exposure position.
5. Development of films; sticks, clamps.
6. Filing of films (celluloid, glass, envelopes).
7. Viewing of films, illumination boxes, etc.

IDENTIFICATION OF FILMS

The identification of several dental films taken of the same individual is not a difficult situation. When six to ten films of the upper and lower dentures are taken, one may lay out a single set of films after development and arrange upper centrals as opposing the lower centrals. The upper centrals have broader crowns than the lowers. The lower centrals are fairly straight teeth and look like slim pegs while the upper centrals are more bullet-shaped and sometimes appear to have a circular constriction or neck at the alveolar margin. The molars are just as easily identified as there are three roots to upper molars and two roots to lower molars. Frequently the upper third and sometimes the upper second molar, have fused roots and present a conical shaped shadow.

Again, upon films of the upper molars and bicuspid we have shadows of the maxillary sinus, which absolutely identifies a film of the upper jaw. In films of the lower bicuspid area, one sees the mental foramen below the apex of a bicuspid tooth (this is frequently misinterpreted as a granuloma or apical abscess). The inferior dental canal is seen upon films of lower molars and even the inferior margin of the lower jaw is seen upon a film which is placed deeply beside the molar area. To recapitulate:

Films of the upper teeth show:

1. Maxillary sinus.
2. Molars have three roots (excepting third).
3. Upper centrals show broad crowns and conical roots.
4. Median raphe distinctly visible.
5. No foramens or dental canals visible.

Films of the lower teeth show:

1. Molars have only two roots.
2. Mental foramen.
3. Inferior border of lower jaw.
4. No maxillary sinus shadow.
5. Lower centrals are straight and peg shaped.
6. No median raphe discernible.
7. Inferior dental canal.

Where the preceding identification is not sufficient one may make punch marks with a fine sharp point in the film before exposing. The punch mark

is placed near the edge of the film which is at the crown of the tooth and at the left lower border if it is the left upper molar area; at the lower middle part if of the upper centrals; at the lower right margin if of the upper molar, etc. The punch mark can be made with a tenaculum forceps but one of the sharp tenaculums must be broken off so that only one fine point penetrates the paper covering the film, otherwise too large a hole will be made and the film about the hole will be fogged. We have had a small tenaculum forceps fixed by adjusting a flat surface upon one of the tenaculum points.

IDENTIFICATION OF PATIENTS

Where one to ten films of several patients are made every day it becomes an exciting task to prevent confusion in the dark room. Of course, the dentist can identify the case sometimes by the fillings in certain teeth shown upon the film but the charting of the dentures is too much to ask of the roentgen technician. Someone has proposed to label the developing sticks or clips. If one is using the stick or clips manufactured by The Eastman Company, a celluloid marker with the patient's name may be placed in one of the clips and carried through to the final filing of the films.

My method is to make a dark-room list of the films as they are exposed, beginning each morning with No. 1 case and making one punch mark upon the lateral margin of all the films taken in the No. 1 case; two punch marks are made for case No. 2; three for case No. 3, etc. After the fifth or sixth case, one can draw a line across the dark room list and start over again with No. 1, because the previous cases will have been developed, dried and mounted by this time. During the day it may be necessary to use three or four sets of dark room lists. Even with making as many as four to ten films of twenty cases a day, this method has worked successfully. Naturally the films must be worked through rapidly and the day's work cleaned up each day.

HOLDING DENTAL FILMS IN PLACE FOR EXPOSURE

There are innumerable devices upon the market for adjusting and maintaining the films in position for exposure. It goes without saying that neither the roentgenologist nor a regular assistant should hold a film with his own fingers. It is too dangerous. This should be an absolute rule. After trying the many devices, one will realize that the finger or thumb of the patient is the best instrument for maintaining the film in proper apposition. It is fairly easy to have the patient hold the films for all of the upper teeth with the thumb. It seems best to hold the films to the lingual surface of the upper teeth by the patient's thumb of the opposite side (right thumb for films of upper left side and *vice versa*) and it is better to instruct the patient to hold the upper and anterior corner of the film against the hard palate rather than to attempt to hold the film against the teeth. The latter method favors the slipping of the film. However, for lower molars and bicuspidis it is well to have an instrument which almost forces the film down low in the mouth so that the roots will show up satisfactorily.

There are several instruments upon the market for this purpose. The first

was introduced about ten years ago (Kny-Scheerer Co.) It has a slot for the film attached to a cork-padded bite-block and the handle is interchangeable at each end of the bite-block so that it can be used for the upper or lower right or left side. Another simpler similiar instrument has recently been placed on the market under the name of the Door Dental film holder (V. Mueller & Co.). A third instrument is the wire film holder designed by Leach, of Chicago, (Victor). This spring wire film holder is so made that the two circles of wire slip between the folds of the No. 1 or No. 2 Eastman films and permit the patient to hold the film in place by the handle. It is interchangeable for right and left sides. Another form is made for anterior teeth. The patient must hold the handle steady. It is not sufficient for the patient to bite the neck of the handle. We shall only mention for the sake of completeness (a) the elaborate set of film holders designed by Ketcham, (b) the cork bite containing the aluminum slip of Rich-Syfert, (c) the mouth balloon of Ciezniske. The aluminum envelope designed by (d) Potts of Spokane is interesting. It requires the large No. 3 Eastman film ($2\frac{1}{4} \times 3$). The patient bites upon the aluminum envelope and the tube focused upon the points attached to the false film. This false film is withdrawn and the true film introduced just before the exposure is made. Stereoscopic films are easily made with this instrument by focusing stereoscopically upon the false film points and then changing films between exposures by hand, the patient's head being fixed rigidly by sandbags attached to a canvas band.

This latter instrument is especially useful in making roentgen records of orthodontic patients. Here one does not require the intimate detail about the roots of the teeth but rather to see a cross section of the teeth and the orthodontic apparatus. It is so easy for the patient to place this apparatus in the mouth and bite down upon it to maintain it in a proper position.

For the orthodontist, an extraoral method of exposure is recommended. The patient is placed upon a table with the affected jaw upon an inclined plane of 25° , with the plate between the jaw and the thick side of the inclined plane at the neck. The tube is focused from below the opposite mastoid process toward the jaw which one wishes to radiograph. This position is attributed at various places in the literature to Haenisch, Quiring and Pfahler. It is possible to obtain interpretable shadows of all the upper and lower molar, bicuspid, and cuspid teeth of one side upon the single plate. By focusing from a point just below the opposite mastoid process toward the mental foramen of the affected side one can sometimes obtain the cuspid teeth also. This method is especially recommended for orthodontics, tumors of the jaws, osteomyelitis, fractures, and impacted third molars where the patient suffers a trismus and can not have a film introduced successfully for an intraoral exposure.