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## X-RAY PICTURES AS EVIDENCE \*

Charles C. Scott †

## I

## GENERALLY

THE courts often are accused of being too slow in accepting the benefits of new inventions, but certainly they are not subject to this criticism in regard to the use of X-ray photographs as evidence. Within a year of Roentgen's discovery of X-rays in 1895, radiographs were admitted in evidence in the case of *Smith v. Grant* tried in the First District Court of Colorado.<sup>1</sup> Ever since then courts have shown little hesitation in permitting the introduction of X-ray photographs in evidence. Today the rule is now firmly settled that with certain definite restrictions X-ray pictures are competent evidence of the internal condition of the human body.<sup>2</sup>

In the early days of X-ray photography it was only possible to obtain shadow pictures of the skeleton, large dense organs such as the lungs, and heavy foreign objects such as bullets. Today, however, much more can be shown by the use of X-rays. It is now possible to take X-ray photographs of the respiratory system, the circulatory system, the alimentary tract and many organs of the body. By the use of substances known as *contrast media*, organs, cavities or tracts of the body can be made to cast a shadow of a different density from that of surrounding structures. For example, by injecting iodized oil into the uterus tubes it is possible to photograph the female genital tract; by injecting a solution of halogen salts intravenously or through the ureters it is possible to photograph the urinary tract; and the use of barium solutions makes it possible to photograph certain hollow organs of the body such as the stomach. In recent years it has even been possible to make X-ray pictures of certain soft parts without the use of these contrast media. But even so, at the present time there is a definite limitation to what can be shown in an X-ray picture. An able discussion of the medical facts that can and cannot be proved by X-ray will be found in a previous issue of the *Review*.<sup>3</sup>

\* See p. 689, supra, note \*.

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<sup>1</sup> 29 CHI. LEG. NEWS 145 (1896).

<sup>2</sup> See the following topics, infra.: *Admissibility in Evidence of X-ray Photographs; Authentication; Interpretation by Experts*, pp.

<sup>3</sup> Donaldson, "Medical Facts That Can and Cannot be Proved by X-ray," 41 MICH. L. REV. 875 (1943).

It is the purpose of the present article to discuss the basic principles of X-ray photography with which every trial lawyer should be familiar. Obviously a detailed discussion of all phases of the subject is beyond the scope of this work but those interested in more detailed information will find several excellent treatises available.<sup>4</sup>

## II

### SELECTION OF TECHNICIANS

Later on it will be shown that when an X-ray photograph is offered in evidence it must be accompanied by proof that the person who made it was qualified by training and experience to take accurate X-ray pictures of the human body.<sup>5</sup> Naturally, therefore, the attorney should do everything within his power to see that any X-ray pictures to be used in a case are made by a qualified operator. Often an X-ray photograph which eventually is used as evidence in a legal controversy is a part of the clinical record made while the subject is in a hospital. When this is the case the lawyer ordinarily has no part in selecting the technician, but usually he can rely on a first class hospital employing only skilled operators for this class of work. There are occasions, however, when the attorney will suggest the making of new X-rays for use as evidence, and in such instances he should be prepared to offer suggestions to the doctor concerning the type of X-ray photographer best qualified to make pictures for use as evidence.

From the legal standpoint, undoubtedly the best type of X-ray photographer is the radiologist, or physician specializing in X-ray work. The attorney usually will have no difficulty in qualifying the radiologist, not only to verify the pictures he has made but also to interpret them. As a practical matter, therefore, the problem of proof is somewhat simplified when X-ray pictures intended for use as evidence are made by radiologists.

Today it will be found that most X-ray photography is not done by radiologists but by specially trained operators having about the same standing as a trained nurse. Such persons are known as X-ray technicians or radiographers. Their basic training includes courses in anatomy, physiology, physics, chemistry and photography as well as X-ray technique. As a rule they work under the direct supervision of a qualified radiologist, physician, surgeon or dentist. While they are competent witnesses to verify pictures they have made, they are not

<sup>4</sup> THOMAS MEDICAL RADIOGRAPHIC TECHNIC, (General Electric X-ray Corp.) (1943). SANTE, MANUAL OF ROENTGENOLOGICAL TECHNIQUE (1944). LONGMORE, MEDICAL PHOTOGRAPHY, RADIOGRAPHIC AND CLINICAL (1944).

<sup>5</sup> See *Authentication*, *infra*, pp. 791-793.

qualified to interpret X-ray pictures.<sup>6</sup> Since X-ray pictures usually must be explained to judge and jury, when pictures are made by X-ray technicians it is necessary to call another witness qualified to interpret X-ray photographs. Of course this can be done, but as a matter of convenience it is easy to see why the radiologist, who can both verify and explain X-rays, is the better witness.

### III

#### EQUIPMENT FOR MEDICAL X-RAY WORK

Essentially X-ray photographic apparatus consists of (1) a vacuum tube, known as an X-ray tube, (2) electric current generating equipment to supply the X-ray tube with current having the required characteristics, and (3) a holder, usually called a cassette, for the film. When supplied with the proper current the X-ray tube generates a beam of X-rays which the operator directs toward the subject he is photographing. The X-ray film is placed on the opposite side of the subject so that the X-rays from the tube must pass through the subject before reaching the film. Exposures are made by simply turning the current on and off.

The lawyer should remember that the basic X-ray equipment is not in any sense a "camera" since it is without lens, shutter, or the dark chamber for which the camera was named. He should never make the mistake of referring to an X-ray machine as a camera when conducting direct or cross-examination. To do so shows ignorance of the elementary principles of X-ray photography. There is only one special circumstance under which an ordinary camera is used in X-ray work and that is when it is desired to photograph the image on the screen of a fluoroscope. By photographing the fluoroscopic image with a miniature camera, small X-ray pictures can be obtained, and by photographing such an image with a motion picture camera, X-ray moving pictures can be secured. This type of X-ray photography is known by various names such as fluorography, indirect radiography and miniature radiography.<sup>7</sup> But even in such work the original image on the screen of the fluoroscope is produced without using a camera.

Since great improvements have been made in X-ray apparatus in recent years, the careful attorney will always insist that pictures intended for use as evidence are made on machines of a late type. There are some surprisingly antiquated installations still in use, even in otherwise up-to-date hospitals, and while in the hands of skilled technicians these old machines will produce results of some clinical value, their use

<sup>6</sup> See *Interpretation by Experts*, infra, pp.

<sup>7</sup> Varden, "Fluorography," 27 J. LAB. AND CLIN. MED. 399 (1941).

for pictures intended as exhibits in court should be avoided whenever possible. It is often difficult for the layman to understand even the clearest X-ray picture produced by an expert operator with the latest type of machine. One must not take any chances of his evidence being misunderstood, therefore, because of the use of inferior apparatus.

#### IV

#### X-RAY FILMS

Ordinary film such as that used in amateur photography could be used to make X-ray pictures but such film would require relatively long exposures. In practice, therefore, special X-ray films are used in medical X-ray photography. In order to secure an emulsion having the highest possible sensitivity to X-rays the ordinary photographic emulsion is altered by greatly increasing the content of sensitive silver salts. To further increase its effectiveness this rich emulsion is *coated on both sides* of the film. But even this special film utilizes only about 1 per cent of the X-rays which strike it, the remaining 99 per cent being wasted. Consequently it is often necessary to sandwich X-ray film between two special screens coated with a substance which has the power to fluoresce (i.e., emit light rays to which photographic film is more sensitive) when exposed to X-rays. These screens, known as *intensifying screens* enable exposures to be made in a small fraction of the time required when they are not used.

Whenever it is available the original film exposed under the patient should ordinarily be obtained for use as evidence. It is true that prints can be made from X-ray films but usually this is not done. An X-ray film is a transparency and it can be demonstrated that transparencies, which ordinarily are examined by holding them up against a light, reveal a far greater scale of lights and shades than paper prints, which must be examined by reflected light. At the present time it is virtually impossible to make a paper print that will show all the detail and delicate gradations of the original X-ray film. With this in mind it is easy to see why the original X-ray film itself is used as evidence.

The superiority of X-ray films over paper prints made therefrom has been recognized by the courts. Thus in an Ohio case<sup>8</sup> it was held that where the original films have been admitted in evidence it is not error to exclude prints made therefrom, especially when the testimony shows that the plates or films are more accurate than the prints. It would seem, however, that duplicate films or even paper prints should be admitted in evidence upon proof that the original X-ray film cannot

<sup>8</sup> Beach v. Chollett, 31 Ohio App. 8, 166 N.E. 145 (1928).

be produced, provided the duplicate film or paper print is verified as an accurate X-ray of the subject.

When jurors or witnesses are examining X-ray films counsel should be certain that they are holding the film the right way. Since both sides of an X-ray film are coated with an emulsion it is easy to make the mistake of looking at it from the back, thereby seeing the subject reversed right as to left, unless the back and face of the film are indicated in some way. Usually an identifying marker is placed on the cassette or holder to mark the film as it is being exposed. The marker is designed so that the film is properly oriented, right as to left, when the lettering made on the film by the marker appears unreversed to the observer. Of course, doctors are usually quite experienced in examining X-ray pictures and rarely make the mistake of looking through the wrong side, but jurors easily can make this error and in some cases it may have serious consequences.

A unique method of permanently identifying an X-ray film is described in a medical journal article as follows:

"It was thought that the image of a patient imprinted on an X-ray film at the time of exposure of the X-ray would be of value not only from the point of identification, but also in medico-legal cases, particularly to avoid substitution. . . . The patient is photographed while his history is written. After the negative is obtained it is developed immediately, then washed in pure alcohol to dry promptly, and placed before an electric fan for about five to seven minutes—less time than is required for an examination. The photographic negative is then placed in the chassis below the X-ray negative, and its contours are marked on the chassis with a pencil. Exposure of the film is then made . . . and a roentgenogram is obtained which simultaneously records the patient's identity.

"This method may be used in cases of trauma to identify persons who have been injured previously, claiming disability for a new injury. It may also be a valuable method in other forms of identification."<sup>9</sup>

In the method just described over and underexposure of the superimposed portrait caused by the different exposure given the X-ray picture is an obvious problem. The originators of the plan propose the use of aluminum filters of determined thicknesses to retard the quantity of rays until the correct exposure will be given the portrait.

<sup>9</sup> Garcia, "X-rays in Identification," 5 J. INTERNAT. COLL. SURGEONS 524 (1942).

## V

## PROBLEMS IN PICTURE-MAKING

A. *Deformation of Shadow*

When the shadows in an X-ray are badly misshapen the picture is said to be distorted. Distortion of the images of bones, organs, or other structures within the body is caused by the improper alignment of X-ray tube, subject, and film. The X-ray technician, therefore, must know how to align apparatus and subject in such a way as to produce shadows on the film corresponding in shape with the bones or other parts of the body they represent. The attorney also should know something about this matter, not necessarily as much as the X-ray technician, but enough to enable him to conduct an intelligent cross-examination when he is suspicious that an X-ray picture is distorted.

Generally speaking, the shape of an X-ray shadow depends upon (1) the position of the subject in relation to the X-ray tube, and (2) the angle at which the X-rays pass through the subject and strike the film. Recollection of an old pastime of one's childhood days, that of forming shadow pictures on the wall, will help in understanding why this is true. One will recall that the shadow was a perfect image of the hand only when the hand was extended parallel to the wall and the light struck the wall in a direction perpendicular thereto. But by changing the position of the hand and varying the angle of light the shadow of the hand on the wall could be made to look like a rabbit, a wolf, a duck or some other animal. Even though we cannot see them, X-rays form shadows in much the same way and, therefore, an X-ray shadow can only show the true shape of an object when the rays strike the film perpendicularly and the object is on a plane parallel with the surface of the film.

In more scientific language it can be said that to produce an X-ray shadow entirely free from distortion (1) the object casting the shadow must be in a direct line between the focal spot of the X-ray tube and the center of the film, (2) the X-rays must pass through the object in a direction perpendicular to the film, and (3) the plane of the film and the plane of the object being radiographed must be parallel.

A moment's reflection will lead to the conclusion that the above conditions rarely are fulfilled in practice because the human body is an object of some bulk and obviously all parts cannot be over the center of the film nor can all planes in the subject be parallel with the surface of the film. Therefore, some distortion will always be present in radiographs of large parts of the body since the X-rays will strike the outer portions more obliquely causing their edges to be distorted more than

the edges of parts at the center of the film. Furthermore, all bones and organs, regardless of their position over the film, will be distorted insofar as they are not parallel with the film.

While distortion cannot be eliminated, it may be kept at a minimum by careful alignment of tube, subject and film. This is where the radiographer's knowledge of anatomy is called into play. In order to align a patient properly with film and tube, the technician must be so thoroughly trained in anatomy that he can visualize the human body as though it were transparent. Otherwise he may cause serious mistakes from the medicolegal standpoint. For instance, broken bones may not appear as such unless the technician postures the patient properly. In order to show the position of parts of broken bones it is necessary to introduce in evidence two X-rays of the subject taken at 90 degrees to each other. Ordinarily one view should be a front view and one a side view. Similarly, in order to show the exact location of a foreign object, such as a bullet lodged within the body two radiographs should be prepared for use as evidence, whenever possible, taken at 90 degrees angle to each other—one a front or back view and the other a side view, for two such radiographs when examined together obviously will enable one to obtain the exact location of the foreign object.

### B. *Magnification*

It is important for the lawyer to know that every direct X-ray image of the human body shows the subject at least slightly magnified, the degree of enlargement increasing with the distance between subject and film or X-ray tube and subject. This is a fact that can be demonstrated to one's own satisfaction with a piece of paper, a pencil and a little pen-size flashlight. Align lamp, pencil and paper in the relative positions normally occupied by X-ray tube, subject and film when a radiograph is made. To do this, place the paper flat on a table with the flashlight directly above it pointing downward so that as the pencil is held a short distance above the paper the shadow of the pencil will be cast on the paper. Remembering that X-rays behave much as visible light rays, one can establish the following important facts from this experiment:

1. The farther the pencil is from the paper the larger will be the shadow on the paper. From this we can conclude that the farther the subject is from the X-ray film the greater will be the magnification of its shadow on the film.

2. The closer the flashlight is to the pencil the larger will be the shadow of the pencil on the paper. Hence, we know that the closer the X-ray tube is to the subject, the greater will be the magnification of the subject on the film.



Furthermore, since some bones and tissues of the human body must always be farther away from the film than others, in a given X-ray picture it will be found that the greatest magnification will be evidenced in the image of those structures at the greatest distance from the film. For example, in the usual chest X-ray, where the patient's chest is placed as close as possible to the film, the spine will be enlarged appreciably more than other parts because it is farthest away from the film.

In many cases the exact size of the X-ray image is of such little importance that the fact that a radiograph shows some magnification does not detract appreciably from its value as evidence. In some cases, however, the size of the X-ray image is of importance in a legal controversy. For example, in X-ray pictures showing bullets embedded within the human body, one must remember that the image of the bullet is magnified and the exact degree of magnification is difficult if not impossible to determine. This is the reason X-ray photographs are not considered conclusive evidence on whether or not a bullet lodged in a body is of a certain caliber.<sup>10</sup> Again, in X-rays of bone tumors poor technique may produce a radiograph showing excessive enlargement of the growth, thereby leading to the impression that the condition is worse than it is in fact. Of course if the distance from object to film and the distance from tube to film are known the degree of magnification can be calculated.<sup>11</sup>

Even apart from medicolegal consideration it is the standard practice of all good radiographers to strive to minimize shadow enlargement. But in X-ray photography of the human body obviously magnification can never be eliminated entirely because it is impossible for all parts of the subject to be in contact with the film. However, the skilful radiographer always places the subject as close as possible to the film and further tries to minimize enlargement by placing the X-ray tube as far away from the subject as is consistent with reasonable short exposure times.

### C. *Importance of Detail in Image*

X-ray photographs intended for use as evidence should show the greatest amount of detail in the subject that the process is capable of producing. Detail refers to the clarity of the picture and may be defined as the distinctness with which the contours of the bones, organs and other structures are shown. Jerman states that when all contour lines of

<sup>10</sup> *Mantino v. Piercedale Supply Co.*, 338 Pa. 435, 13 A. (2d) 51 (1940).

<sup>11</sup> "Enlargements in Radiographic Projection," 18 *RADIOGRAPHIC AND CLINICAL PHOTOG.* No. 2 (1942) (gives table for computing degree of magnification).

objects show and when the lines of cancellous structure of bones are clean cut, sharp and distinct, the detail may be said to be good; when these lines are more or less hazy and indefinite, the detail is not so good.<sup>12</sup> Poor detail may be caused by a number of conditions including movement of the subject, too short a distance between X-ray tube and film, scattered radiation uncontrolled by Potter-Bucky diaphragm, and use of an X-ray tube having too large a focal spot.

Since the most distinct radiographs are hard enough for the average layman to understand, detail is especially important in X-ray photographs intended for use as evidence. A physician may be able to make a correct diagnosis from a more or less blurred X-ray photograph, but the jury will learn nothing from such an exhibit. The result sought should always be a picture that will enable the jury to see as well as hear the testimony in the case.

#### D. *Exposure*

The problem of exposure is far more critical in X-ray photography than it is in some other phases of legal work, such as the photography of accident scenes. An improperly exposed radiograph has little or no value as evidence because underexposure results in loss of detail in the more transparent portions of the film and overexposure causes loss of detail in the blacker parts of the film. Either condition seriously reduces the value of the radiograph as a means of medical or surgical diagnosis and, hence, its value as evidence. The ability to produce properly exposed X-rays is, therefore, one of the most important parts of a radiographer's training. Fortunately, by the time the X-ray technician has obtained sufficient experience to be entrusted with medicolegal cases he is able to turn out correctly exposed radiographs with surprising regularity. Besides it is the usual practice to develop X-ray films while the patient stands by so that the picture can be retaken if an examination of the wet film while it is still in the hypo shows that it is not satisfactory. Consequently, improperly exposed radiographs are not seen in the courtroom as frequently as over and underexposed photographs of other types. But the lawyer should know enough about the factors which control the exposure in radiography to cross-examine intelligently on the point.

Most of the exposure factors involved in radiography are different from those involved in photography with a camera. In X-ray work the proper exposure time (electricity on-and-off time) depends primarily upon (1) speed of the film and multiplying factor of the intensifying

<sup>12</sup> JERMAN, MODERN X-RAY TECHNIC 120 (1928).

screens, (2) milliamperage of current used, (3) voltage supplied to the X-ray tube, (4) distance from X-ray tube to film, and (5) density (relative opaqueness to X-rays) of the subject.

The speed of the film and multiplying factor of the intensifying screens are easily determined from data supplied by the manufacturers. When the same brand of film and same intensifying screens are used regularly this factor remains constant and causes little difficulty.

The milliamperage factor is controlled by the radiographer during the exposure by means of a milliamperemeter. In most X-ray laboratories a constant milliamperage for each class of work usually is adopted. In medicolegal work as in all other types of medical radiography the milliamperage is kept as low as is consistent with convenient exposure time, since too high a milliamperage may cause serious burns to the subject.

The voltage is set for each X-ray picture by using the voltmeter which is a part of the X-ray apparatus. The voltage is the factor which is most frequently varied. When all other factors remain the same, increasing the voltage shortens the time of exposure.

The distance from X-ray tube to film is always kept as great as possible in order to minimize magnification.

The density of the subject is the factor requiring the most knowledge on the part of the operator. Obviously different exposures are required for each individual because a large body will obstruct more rays than a small one. Similarly, different parts of a given body require different exposures. The hand, for example, requires a shorter exposure than the chest, other conditions being equal.

While the above five factors are the primary consideration, there are certain other practical problems in determining exposure. For instance, consideration must be given to the possibility of the patient moving during the exposure and blurring the picture, destroying its usefulness as evidence. When making X-ray exhibits of the head and the extremities, time exposures may be given; but with the trunk of the body, the shortest possible exposures are required to overcome movement caused by respiration, heart action and peristalsis.

Formerly exposure time for X-ray work was calculated by the use of exposure charts, but today rugged and dependable photoelectric exposure meters are available. The most advanced instrument of this type is a combined photoelectric exposure meter and timer which shuts the current off as soon as the film has received the proper exposure.

The lawyer should note particularly that in the above discussion of X-ray exposure factors nothing was said about the speed of a lens. In

cross-examining an X-ray technician on exposure, the lawyer should not make the ridiculous mistake of asking the speed of his lens because X-ray apparatus does not have a lens. As mentioned before, the ordinary lens-equipped camera is used in X-ray work only to make reduced negatives or motion pictures by copying the image on the screen of a fluoroscope.

### E. *Special Picture-taking Technique*

1. *When permissible.* In all discussion of photographic evidence much is said about the importance of "pure photography," but in medicolegal X-ray work, as in other types of legal photography, there are times when unusual procedures are proper because an accurate X-ray picture of an internal injury cannot always be obtained by simply placing X-ray tube, patient and film in the proper positions. Accordingly the use of special technique is permissible provided the method employed is shown to yield accurate radiographs. For example, in making an X-ray picture to show a partial dislocation of the sacroiliac joint it is proper to exert *equal* traction on both legs to pull the bones apart while the picture is being taken if the traction is necessary to make the dislocation show in the picture.<sup>13</sup> Similarly, in X-raying a sprained wrist that is deformed and disfigured it is proper for an X-ray specialist to straighten the hand and hold it down while an assistant takes the picture.<sup>14</sup>

The most common type of special X-ray technique is the use of special injections called *contrast media*. Pictures of the internal organs of the body often cannot be obtained without in some way injecting a substance that is relatively impervious to X-rays into the organ before the picture is taken. In *Yarbrough v. Carlson*,<sup>15</sup> a picture showing an intestinal adhesion was admitted and the decision includes a reference to the fact that the patient was given a sulphate (probably barium sulphate) in buttermilk before the picture was taken in order to make the adhesion cast a shadow on the X-ray film. In that case there was no question on appeal as to the effect of this special technique upon the admissibility of the photograph, nor in principle does it seem that any valid objection to the method could be raised since it only enables an X-ray photograph to show what otherwise could not be shown and is no more objectionable than the dusting of a fingerprint with powder before photographing it.

2. *Stereoscopic X-ray Photographs.* In X-ray photography the

<sup>13</sup> *Cooney v. Hughes*, 310 Ill. App. 371, 34 N.E. (2d) 566 (1941).

<sup>14</sup> *Hill v. Meyer*, (Mo. App. 1920) 221 S.W. 171.

<sup>15</sup> 102 Ore. 422, 202 P. 739 (1921).

stereoscopic or third dimensional effect can be produced by making two radiographs of the subject from slightly different angles, the X-ray tube usually being positioned about one and one-quarter inches to the left of the center of the subject for one picture and the same distance to the right of center for the other. The total tube shift normally is thus two and one-half inches, corresponding with the separation of the pupils of the human eyes. In certain cases the X-ray technician must increase the normal tube shift of two and one-half inches in order to give a better separation of the parts of subject. When two radiographs made in this way are examined with the proper viewing apparatus, the observer gets the effect of looking at a solid object rather than a flat picture.

From the medicolegal standpoint stereoscopic X-ray photographs are particularly helpful for showing conditions in the chest, vertebral column and skull. They are also useful in showing the location of foreign bodies such as bullets embedded in regions of the body like the shoulders or hip joints. It is often difficult or impossible to obtain two good views at right angles of these regions, and, therefore, ordinary radiographs of such parts usually are of little value in locating a bullet accurately. But stereoscopic photographs of the same regions usually are very helpful.

The lay observer, such as the average juror, can only see the third dimensional effect produced by a pair of stereoscopic X-ray pictures when they are shown to him in a properly constructed viewing machine. Probably this is the principle reason stereoscopic X-ray pictures have not been used to any great extent in the courtroom. But the conscientious attorney will not deprive his client of the benefit to his cause to be obtained by having the jury see such exhibits simply because he does not want to go to the trouble of having stereoscopic viewing apparatus brought into court. Nor should he plan to have the pictures withdrawn from the courtroom for examination in a viewing device since this may be refused. In a Texas case it was held that there was no error in refusing to permit stereoscopic X-rays to be withdrawn from the court to permit their examination by use of a viewing machine because one of the X-ray experts testified that the films could be properly examined and read by him in court without the aid of a stereoscopic machine.<sup>16</sup>

There is now a new process of stereoscopic radiography called trivision.<sup>17</sup> This process combines the use of lenticular film (ordinary

<sup>16</sup> *Hicks Rubber Co. v. Harper*, (Tex. Civ. App. 1939) 131 S.W. (2d) 749, error dismissed 132 S.W. (2d) 579 (1939).

<sup>17</sup> WINNEK, ROENTGENOGRAPHY: THREE-DIMENSIONAL, MEDICAL PHYSICS 1324 (1944).

photographic film embossed on the base side with microscopically small lens ridges or lenticulations) and a scanning camera. The finished picture can be examined by the jurors without the use of any viewing device. As yet the results obtained are not quite as good as those obtained by older methods but since the film can be studied by the unaided eye, trivision has distinct advantages in medicolegal work.

## VI

### PERSONAL IDENTIFICATION BY MEDICAL AND DENTAL X-RAYS

#### A. Generally

In numerous cases X-ray pictures of parts of the human body can furnish positive means of personal identification. This is especially true of dental X-rays because as a person matures and ages his teeth acquire individual characteristics as a result of dental work. Therefore, when a dentist takes a set of X-ray pictures of a person's teeth he makes a pictorial record of that person that probably will not be duplicated in the X-rays of any other individual. This fact would have given the defendant an air-tight alibi in *People v. Greenspawm*,<sup>18</sup> a forgery case in which the defendant contended that at the very time the forged check was being written in one city he was in another city at the office of an X-ray technician having his teeth X-rayed. Defendant's counsel offered to put the X-ray technician on the stand to testify that from a comparison of X-rays of defendant's mouth made shortly before the trial with the X-rays made of his mouth at the time the crime was committed he could say that the subject of both examinations was the same person, thereby proving that defendant could not have been the perpetrator of the forgery committed at the time he was having his teeth X-rayed. While the trial court excluded this evidence, on appeal it was held that it should have been admitted inasmuch as it tended to sustain defendant's alibi.

Besides the teeth some of the bones of the body may furnish means of personal identification by X-rays, especially when they have been subjected to injury. For instance, in a Texas murder case, where the body of the victim was badly decomposed when found, it was held proper for a doctor who had treated deceased for a gunshot wound in the lower leg to testify that a hole in the "lower leg bone" of the corpse corresponded with a hole shown on X-ray photographs which he had made of his patient's leg at the time he had treated him.<sup>19</sup>

<sup>18</sup> 346 Ill. 484, 179 N.E. 98 (1931).

<sup>19</sup> *Cantrell v. State*, 129 Tex. Cr. R. 240, 86 S.W. (2d) 777 (1935).

Of course, in the last mentioned case it was the injury to the bone that enabled the doctor to make the identification, but certain parts of the skeleton have sufficient individual characteristics to enable an expert to identify them apart from injury. According to Dr. Frederick M. Law of New York, X-ray photographs of the nasal and accessory sinuses and mastoid processes have exceptional potential value for identification purposes. In a medical journal article he described a case in which he was able to identify a badly disfigured body by this means. The person in question was X-rayed when he was operated upon for left-sided mastoiditis in 1920. In 1925 he went to India where he suddenly disappeared from his camp on the Indus River. Some days later the bodies of two men, disfigured beyond recognition, were recovered from the river seventy miles below the camp. The left nasal scars on one of the bodies led the investigators to believe that the remains were those of the person Dr. Law had operated upon. The body was therefore shipped to New York in order that Dr. Law could attempt to identify it by the roentgenograms in his possession. With reference to the identification by the X-rays of the nasal and accessory sinuses and mastoid processes, Dr. Law wrote:

“Fingerprints on record would have been of no aid, for one arm was gone and there was scarcely any flesh on the bones of the other hand. The facial bones were bare of flesh. However, an examination of the sinuses and mastoids with a portable machine at the morgue and comparisons of the resulting films with the plates on file, established beyond any possibility of doubt that both sets of roentgenograms were of one and the same individual. The operation on the left mastoid following the first examination had destroyed its value for identification, but as both sides had been examined, the right mastoid was available for comparison. Thirteen points of identity in the sinuses and seven in the right mastoid were noted; the number could have been extended indefinitely.”<sup>20</sup>

While ordinary medical X-rays obviously will not be called into use very frequently as means of personal identification, the above cases illustrate how valuable they may be when other more common means of personal identification, such as fingerprints, are impractical.

### B. *X-ray Fingerprints*

An X-ray picture made expressly for identification is the X-ray

<sup>20</sup> Law, “Roentgenograms as a Means of Identification,” 26 AMER. J. SURG., N.S. 195 (1934).

fingerprint, often called a "dactyloscopic radiograph." The ordinary X-ray photograph does not show the friction ridges of the skin but by dusting the skin with a substance that is opaque to X-rays a satisfactory radiograph of the friction ridges can be obtained. The hand to be X-rayed in this manner is first smeared with a coating of bismuth, lead carbonate, or a mixture of 20 parts of white lead to 100 parts of paraffin. All of these substances are relatively opaque to X-rays. The excess of the salt is removed so that the depressions or furrows are filled while the ridges are left clear. Hence, the salt impregnated depressions are rendered opaque to X-rays and therefore photograph as transparent lines, and the uncoated ridges let the X-rays through, and therefore, appear black on the X-ray film. The result is an X-ray photograph that shows the numerous characteristics of the papillary ridges so well that even the pores sometimes can be discerned.

Obviously dactyloscopic radiography was never intended to take the place of the ordinary methods of taking fingerprints and palm-prints from inked hands. Ordinarily, the X-ray procedure is resorted to only when circumstances make it impossible to ink the fingers to obtain an imprint that can be enlarged by photography for comparison purposes. Practically the only occasion for the use of dactyloscopic radiography is in the taking of fingerprints of a corpse that is in an advanced state of putrefaction. If sufficiently advanced, decomposition will render the skin tissue so macerated that any attempt to make an ink impression of the fingers will yield blurred results or even cause the skin to peel off and adhere to the inking plate. Under these conditions a properly taken radiograph of the hand will reproduce the ridge pattern so perfectly that it can be enlarged and compared with other fingerprints to establish identity.

The dactyloscopic radiograph, like any other X-ray picture, will show some magnification of the subject, but if it is made properly, with the hand as close as possible to the film, it will be only slightly larger than life size. To make it useful for courtroom purposes it must be enlarged several diameters and printed on paper so that it can be compared with other fingerprints made in the usual way. Since the ridges appear as black lines on the original X-ray film we must make a photographic copy of it, thereby securing an intermediate transparency that will show the ridges as transparent lines and the depressions as opaque lines. The court exhibit is made by placing this intermediate transparency in an enlarger and enlarging it in the same way an ordinary negative is enlarged. The resulting enlargement will show the ridges as black lines, just as did the original X-ray negative.



## VII

## ADMISSIBILITY IN EVIDENCE OF X-RAY PHOTOGRAPHS

X-ray photographs are recognized by the courts as scientific, trustworthy representations.<sup>21</sup> It has been held that accurate X-ray pictures are the best evidence that can be obtained of the internal condition of the living body without a surgical operation (biopsy), to which no one would be called upon to submit.<sup>22</sup> Accordingly, the admissibility in evidence of X-ray photographs, when relevant and when properly verified, no longer remains an open question.<sup>23</sup>

Most frequently X-ray pictures are admitted in evidence to show the internal condition of the body of someone involved in a given case. Thus in personal injury actions verified X-ray photographs of the plaintiff are admissible on the question of the nature and extent of his injuries.<sup>24</sup> Likewise, in criminal cases duly authenticated photographs

<sup>21</sup> *Kramer v. Henely*, 227 Iowa 504, 288 N.W. 610 (1939).

<sup>22</sup> *City of Geneva v. Burnett*, 65 Neb. 464, 91 N.W. 275 (1902).

<sup>23</sup> *Phillips v. Wilmington & Philadelphia Traction Co.*, 1 Harr. (1 Del.) 593, 117 A. 241 (1922).

<sup>24</sup> *Chicago, B. & Q. R.R. Co. v. Upton*, (C.C.A. 8th, 1912) 194 F. 371; *Birmingham v. Mauzey*, 214 Ala. 476, 108 S. 382 (1926) (ankle); *Arizona Eastern R.R. Co. v. Head*, 26 Ariz. 137, 222 P. 1041 (1924); *Arkansas Amusement Corp. v. Ward*, 204 Ark. 130, 161 S.W. (2d) 178 (1942); *Wilburn v. United States Gypsum Co.*, 16 Cal. App. (2d) 111, 60 P. (2d) 188 (1936) (vertebra); *Phillips v. Wilmington & Philadelphia Traction Co.*, 1 Harr. (1 Del.) 593, 117 A. 241 (1922) (hip and thigh); *Call v. City of Burley*, 57 Idaho 58, 62 P. (2d) 101 (1936) (pelvis); *Griswold v. Chicago Rys. Co.*, 339 Ill. 94, 170 N.E. 845 (1930), affirming 253 Ill. App. 498 (1929) (femur); *Kickels v. Fein*, 104 Ind. App. 606, 10 N.E. (2d) 297 (1937) (leg); *Kramer v. Henely*, 227 Iowa 504, 288 N.W. 610 (1939) (spine); *Mercado v. Nelson*, 118 Kan. 302, 235 P. 123 (1925); *Consolidated Coach Corp. v. Saunders*, 229 Ky. 284, 17 S.W. (2d) 233 (1929) (leg); *Baltimore & Ohio R.R. Co. v. Whitacre*, 124 Md. 411, 92 A. 1060 (1915) (pelvis); *Doyle v. Singer Sewing Machine Co.*, 220 Mass. 327, 107 N.E. 949 (1915) (injury to bony structure of face); *Roach v. Petrequin*, 234 Mich. 551, 208 N.W. 695 (1926) (leg); *Brookman v. Chicago Great Western R.R. Co.*, 116 Minn. 409, 133 N.W. 969 (1912) (leg); *Beard v. Turrutin*, 173 Miss. 206, 161 S. 688 (1935) (spine); *Clark v. Reising*, 341 Mo. 282, 107 S. W. (2d) 33 (1937); *City of Geneva v. Burnett*, 65 Neb. 464, 91 N. W. 275 (1902) (foot and ankle); *Clark v. Sears*, 12 N. J. Misc. 354, 171 A. 557 (1934); *Eaker v. International Shoe Co.*, 199 N.C. 379, 154 S.E. 667 (1930) (vertebra); *Asch v. Washburn Lignite Coal Co.*, 48 N. D. 734, 186 N. W. 757 (1922) (spine); *McKee v. New Idea, Inc.*, (Ohio App. 1942) 44 N.E. (2d) 697 (lungs); *Jones v. Sinsheimer*, 107 Ore. 491, 214 P. 375 (1923); *Bottinger v. Independence Indemnity Co.*, 108 Pa. Super. 39, 164 A. 737 (1933) (knee); *Bruce v. Beall*, 99 Tenn. 303, 41 S. W. 445 (1897) (leg); *Southern Underwriters v. Waddell*, (Tex. Civ. App. 1940) 144 S. W. (2d) 647; *Russell v. Borden's Condensed Milk Co.*, 53 Utah 457, 174 P. 633 (1918) (pelvis); *Manos v. James*, 7 Wash. (2d) 695, 110 P. (2d) 887 (1941) (spine); *Griffith v. American Coal Co.*, 75 W. Va. 686, 84 S. E. 621 (1915) (pelvis); *Mauch v. City of Hartford*, 112 Wis. 40, 87 N. W. 816 (1901) (arm, wrist and hand).

of the victim or the defendant are admissible provided they show injuries pertinent to some issue in the case.<sup>25</sup> Similarly, in malpractice cases X-ray pictures of the plaintiff's body are admissible whenever they are of evidential value on the issue of the doctor's negligence or the extent of damages resulting from his negligence.<sup>26</sup> And of course verified X-ray photographs are admissible in any other type of action provided they are relevant and material.<sup>27</sup>

There is, however, this noteworthy exception to the admissibility of relevant X-ray photographs: While at common law communications between physician and patient were not privileged, some of our American states have passed statutes of varying sorts creating such a privilege. Generally, the effect of such a statute, aside from special exceptions, is to make the physician incompetent, without consent of the patient, to testify concerning communications made as a part of diagnosis or treatment.<sup>28</sup> It has been held under such a statute that X-ray pic-

<sup>25</sup>Johnson v. State, 27 Ala. App. 5, 165 S. 402 (1935), cert. denied 231 Ala. 466, 165 S. 403 (1936) (X-ray picture showing fracture of skull of deceased admissible to aid jury in considering conflict in testimony on number of blows struck); State v. Casey, 108 Ore. 386, 213 P. 771, 217 P. 632 (1923) (defendant's wounded arm; murder case); State v. Enloe, 147 Ore. 123, 31 P. (2d) 772 (1934) (nose of prosecuting witness; assault and battery case); State v. Coleman, 96 W. Va. 544, 123 S. E. 580 (1924) (defendant's skull).

<sup>26</sup>Miller v. Mintun, 73 Ark. 183, 83 S. W. 918 (1904) (ankle); Sim v. Weeks, 7 Cal. App. (2d) 28, 45 P. (2d) 350 (1935) (arm); Bonnet v. Foote, 47 Cal. 282, 107 P. 252 (1910) (fractured femur); Reinhold v. Spencer, 53 Idaho 688, 26 P. (2d) 796 (1933) (chest; showing hypodermic needle left in plaintiff's thoracic cavity after operation); Krauss v. Ballinger, 171 Ill. App. 534 (1912) (fractured arm); Walker Hospital v. Pulley, 74 Ind. App. 659, 127 N. E. 559 (1920) (teeth); McMillen v. Foncannon, 127 Kan. 573, 274 P. 237, 128 Kan. 187, 276 P. 820 (1929) (fractured arm); Powell v. Galloway, 229 Ky. 37, 16 S. W. (2d) 489 (1929) (fractured arm); Jameson v. Weld, 93 Me. 345, 45 A. 299 (1899) (elbow dislocation); Stokes v. Long, 52 Mont. 470, 159 P. 28 (1916) (fractured leg); Carlson v. Benton, 66 Neb. 486, 92 N. W. 600 (1902) (fractured leg); Vale v. Campbell, 123 Ore. 632, 263 P. 400 (1928) (fractured leg); Davis v. Dunn, 90 Vt. 253, 98 A. 81 (1916) (injured arm); Miller v. Dumon, 24 Wash. 648, 64 P. 804 (1901) (fractured leg); Jenkins v. Charleston General Hospital & Training School, 90 W. Va. 230, 110 S. E. 560 (1922) (injured arm).

<sup>27</sup>Volunteer State Life Ins. Co. v. Davis, (Ala. App.) 14 S. (2d) 162, cert. denied (Ala. 1943) 14 S. (2d) 168; Equitable Life Assn. Soc. v. Reynolds, 259 Ky. 504, 82 S. W. (2d) 509 (1935).

<sup>28</sup>For a comprehensive summary of the American legislation, see, in the Symposium series, "Scientific Proof and Relations of Law and Medicine" (1st series, April, 1943) the study by Chafee, "Privileged Communications: Is Justice Served or Obstructed by closing the Doctor's Mouth on the Witness Stand?" 52 YALE L. J. 607 (1943). Professor Chafee says at 607: "Seventeen states still seem to preserve the view of the English common law that there is no legal check upon the revelation of medical secrets. On the witness stand, at all events, a doctor in these states must tell all he knows. [Alabama, Connecticut, Delaware, Florida, Georgia, Illinois, Maine, Maryland, Massa-

tures taken by or for an individual's personal physician are to be considered a part of the information acquired by the physician in his confidential relationship and ordinarily cannot be used or referred to by the

chusetts, New Hampshire, New Jersey, Rhode Island, South Carolina, Tennessee, Texas, Vermont, and Virginia.]

"The remaining states adopt a half-way attitude towards the obligation of secrecy, of which the New York statute is typical. [First enacted in 1828. See N. Y. Civil Practice Act (1920) §§ 352, 354, as subsequently amended.] Unless the patient consents, the doctor is not allowed, while testifying in court, 'to disclose any information which he acquired in attending a patient in a professional capacity and which was necessary to enable him to act in that capacity.' Thus there is no liability to the patient if the doctor tells every last detail in clubroom gossip or in the thickly veiled items of a medical journal, but he is prohibited from divulging any of the truth in the place where it is usually most stringently required—the witness stand. Some of these statutes make exceptions for special medical situations where disclosure is badly needed, like abortion."

Professor Chafee, at 607, note 4, summarizes these particular statutes as follows: "The ensuing list mentions only the date of the original enactment without regard to subsequent amendments. The statutes vary in their terms, particularly as to waiver of the privilege. The ensuing list mentions only variations of especial medical interest, including the fact of adoption of the Uniform Narcotic Drug Act (U.N.D.A.): Alaska (1913) (except for insanity); Arizona (1913) (U.N.D.A.); Arkansas (1919); California (1872) (except for mental condition and venereal disease); Canal Zone (1934); Colorado (1921); District of Columbia (1919) (U.N.D.A.); Georgia (1935); Hawaii (1925) (U.N.D.A.); Idaho (1919); Indiana (1926); Iowa (1897) (U.N.D.A.); Kansas (1923); Kentucky (1915); Louisiana (1928); Maryland (1935) (U.N.D.A.); Michigan (1915) (except for illegal marriage of persons sexually diseased); Minnesota (1913) (except for bastardy); Mississippi (1906); Missouri (1919) (except for abortion); Montana (1935) (U.N.D.A.); Nebraska (1922) (U.N.D.A.); Nevada (1912) (U.N.D.A.); New Mexico (1929) (U.N.D.A.); New York (1828) (except for narcotic investigations); North Carolina (1919) (allows presiding judge of superior court to compel disclosure when necessary to administration of justice, U.N.D.A.); North Dakota (1913); Ohio (1921) (U.N.D.A.); Oklahoma (1931) (U.N.D.A.); Oregon (1920) (U.N.D.A.); Pennsylvania (1895); Philippine Islands (1901); Puerto Rico (1911) (except for malpractice, U.N.D.A.); South Carolina (1934) (U.N.D.A.); South Dakota (1919) (U.N.D.A.); Utah (1917) (U.N.D.A.); Virgin Islands (1920); Washington (1909); West Virginia (1897) (U.N.D.A.); Wisconsin (1919) (except for lunacy and malpractice, U.N.D.A.); Wyoming (1920) (U.N.D.A.)."

Professor Chafee points out at 607-608 that: "several of the states recognizing the doctor-patient privilege in general have adopted the Uniform Narcotic Drug Act, which provides [in § 17, par. 2,] that 'information communicated to a physician in an effort unlawfully to procure a narcotic drug, or unlawfully to procure the administration of any such drug, shall not be deemed a privileged communication.'"

He states at 608, note 5, that "This statute has been adopted in the following states and territories, of which those starred in the list do not recognize a general doctor-patient privilege: Arizona, District of Columbia, Hawaii, Iowa, Maryland\*, Montana, Nebraska, Nevada, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Puerto Rico, South Carolina\*, South Dakota, Tennessee\*, Texas\*, Vermont, West Virginia, Wisconsin, Wyoming."

See in the present Symposium series, Tracy, "The Doctor as a Witness," *ANNALS OF INTERNAL MEDICINE* (April or May, 1946).

opposing side unless the patient waives the privilege by introducing the X-rays in evidence.<sup>29</sup>

Under proper conditions X-ray photographs of strangers to the action may be admitted in evidence for the purpose of comparison. For example, by the great weight of authority X-ray photographs duly authenticated as correct representations of a normal human body are admissible in evidence to enable the court and jury to understand in what respect X-ray pictures of the person in question show deviations from the normal.<sup>30</sup> Again, X-ray pictures of strangers to the action showing similar injuries or pathological conditions similar to those involved in the case may be admitted in evidence for the purpose of illustration.<sup>31</sup> The competency of such uses of X-ray photographs is beyond question, it being comparable to the use of skeletons, charts and diagrams to show the structure of the human body, a practice which was common in trials even before photographs were used.<sup>32</sup>

#### A. Authentication

Before an X-ray can be admitted in evidence someone who has knowledge of the fact must take the stand and verify the accuracy of the picture, for X-ray photographs are not admissible in evidence without preliminary proof of their accuracy.<sup>33</sup> But this proof need only relate to the particular X-ray picture in question, for today the science of X-ray photography is too well founded and generally recognized to render it any longer necessary for a witness to testify to the reliability and trustworthiness of the X-ray process itself before X-ray pictures are admitted in evidence.<sup>34</sup>

<sup>29</sup> *Aspy v. Botkins*, 160 Ind 170, 66 N.E. 462 (1903); *Tonkel v. Yazoo & M.V.R.R. Co.*, 170 Miss. 321, 154 S. 351 (1934); *Hansen v. Sandvik*, 128 Wash. 60, 222 P. 205 (1924).

<sup>30</sup> *De Martini v. McDonnell*, 14 Cal. App. (2d) 405, 58 P. (2d) 170 (1936) (pelvis of normal woman about the age, size and figure of plaintiff); *Haywood v. Dering Coal Co.*, 145 Ill. App. 506 (1908) (normal ankle); *Boddington v. Kansas City*, 95 Kan. 189, 148 P. 252 (1915); *McGrath v. Fash*, 244 Mass. 327, 139 N.E. 303 (1923) (normal pelvis); *Draxten v. Brown*, 197 Minn. 511, 267 N.W. 498 (1936) (normal pelvis); *Chicago, R.I. & G. Ry. Co. v. Smith*, (Tex. Civ. App. 1917) 197 S.W. 614 (normal foot); *Virginian Ry. Co. v. Bell*, 118 Va. 492, 87 S.E. 570 (1916) (normal neck). *Contra* but unsound: *Eggert v. Binder*, 100 N.J.L. 174, 1 N.J. Misc. 555, 125 A. 106 (1924); *Davis v. Dunn*, 90 Vt. 253, 98 A. 81 (1916).

<sup>31</sup> *Norland v. Peterson*, 169 Wash. 380, 13 P. (2d) 483 (1932).

<sup>32</sup> *State v. Knight*, 43 Me. 11 (1857) (medical drawings of human neck admitted to enable physician to testify intelligently regarding injuries to spinal column).

<sup>33</sup> *Gulf Research Development Co. v. Linder*, 177 Miss. 123, 170 S. 646 (1936); *West v. Wilson*, 90 Mont. 522, 4 P. (2d) 469 (1931); *State v. Capawanna*, 118 N.J.L. 429, 193 A. 902 (1937).

<sup>34</sup> *Call v. City of Burley*, 57 Idaho 58, 62 P. (2d) 101 (1936); *Ingebretsen v. Minneapolis & St. Louis R.R. Co.*, 176 Iowa 74, 155 N.W. 327 (1915).

Since an X-ray picture purports to show only shadows of objects not otherwise visible to the eye it is evident that a witness's verification of an X-ray photograph ordinarily must be based on the scientific fact that the properly taken X-ray photograph as accurately pictures the shadows of internal objects as does the ordinary photograph picture an object's external surface.<sup>35</sup> Therefore, in verifying an X-ray picture ordinarily the following requirements should be met, although it is not uncommon for X-rays to be admitted in evidence without one or more of them being satisfied:

1. The X-ray film should be identified as a picture of the person whose condition is in question.<sup>36</sup> Since X-ray pictures usually are taken by technicians who make hundreds of pictures a week, usually the only practical way to identify a film as being a picture of the person in question is by the use of identification marks verified by some competent witness.

2. There should be proof that the physical condition of the subject at the time of being X-rayed was the same as at the time in issue.<sup>37</sup> This requirement is usually satisfied by testimony of the injured party that after the time in question and before the X-ray pictures were taken he suffered no additional injury to the part of the body under consideration.

3. It should be shown that the X-ray apparatus used was dependable and in good working condition.<sup>38</sup>

4. There should be testimony that the person who took the picture was qualified by training and experience to take accurate X-ray pictures of the human body.<sup>39</sup>

5. The manner of taking the X-ray picture should be completely described, especially in such particulars as the distance from the X-ray tube to the subject, the distance between subject and film, the angle

<sup>35</sup>Call v. City of Burley, 57 Idaho 58, 62 P. (2d) 101 (1936).

<sup>36</sup>Joy v. Flax, 101 N.J.L. 43, 127 A. 596 (1925); Kossoff v. Kupferberg, 91 Misc. 1, 154 N.Y.S. 149 (1915); Lake Shore Electric Ry. v. Hobart, 32 Ohio Cir. Ct. R. 154 (1909); Texas Indemnity Ins. Co. v. Phillips, (Tex. Civ. App. 1941) 153 S.W. (2d) 503.

<sup>37</sup>See Judejko v. Chicago City Ry. Co., 166 Ill. App. 140, 145 (1911).

<sup>38</sup>Stevens v. Illinois Cent. R.R. Co., 306 Ill. 370, 137 N.E. 859 (1923); Ligon v. Allen, 157 Ky. 101, 162 S.W. 536 (1914); Gulf Research Development Co. v. Linder, 177 Miss. 123, 170 S. 646 (1936); West v. Wilson, 90 Mont. 522, 4 P. (2d) 469 (1931); Joy v. Flax, 101 N.J.L. 43, 127 A. 596 (1925); Eaker v. International Shoe Co., 199 N.C. 379, 154 S.E. 667 (1930); Lake Shore Power Co. v. Meyer, 51 Ohio App. 534, 1 N.E. (2d) 1021 (1935); Bartlesville Zinc Co. v. Fisher, 60 Okla. 139, 159 P. 476 (1916); Federal Underwriters Exchange v. Cost, (Tex. Civ. App. 1938) 115 S.W. (2d) 706; Griffith v. American Coal Co., 75 W. Va. 686, 84 S.E. 621 (1915).

<sup>39</sup>Stevens v. Illinois Cent. R.R. Co., 306 Ill. 370, 137 N.E. 859 (1923).

from which the X-rays were directed through the body onto the film, and the length of exposure.<sup>40</sup>

A perusal of the above requirements inevitably will lead to the conclusion that whenever possible the authentication of an X-ray picture should be made by the physician, dentist or X-ray technician who took the picture. But it has been held that even though the X-ray photographer is not called as a witness, an X-ray film may be sufficiently identified by a physician, dentist or X-ray technician who was present when the picture was made and knows the conditions under which it was made, even though he did not take the picture himself.<sup>41</sup> Authentication by a witness who did not see the picture taken is unsatisfactory and does not render the picture admissible according to the better reasoned cases,<sup>42</sup> but there are decisions to the contrary.<sup>43</sup>

The question as to whether an X-ray picture is sufficiently identified is a matter left largely to the discretion of the trial judge.<sup>44</sup> But his discretion is not unlimited.<sup>45</sup> Where uncontradicted testimony leaves no room for a difference of opinion as to the accuracy of the picture, it is an abuse of discretion and reversible error for a trial judge to exclude a relevant X-ray picture.<sup>46</sup> Accordingly, it is common practice for the appellate courts to pass upon the sufficiency of the verification of an X-ray photograph when the question is properly raised.<sup>47</sup>

<sup>40</sup> Baltimore & Ohio R.R. Co. v. Whitacre, 124 Md. 411, 92 A. 1060 (1915).

<sup>41</sup> Arkansas Amusement Corp. v. Ward, 204 Ark. 130, 161 S.W. (2d) 178 (1942); Phillips v. Wilmington & Philadelphia Traction Co., 1 Harr. (1 Del.) 593 117 A. 241 (1922); Reinhold v. Spencer, 53 Idaho 688, 26 P. (2d) 796 (1933); Wicks v. Cuneo-Henneberry Co., 319 Ill. 344, 150 N.E. 276 (1926); State v. Matheson, 142 Iowa 414, 120 N.W. 1036 (1909); State v. Matheson, 142 Iowa 414, 120 N.W. 1036 (1909); Very v. Willi, (Mo. App. 1927) 293 S.W. 500; Clark v. Sears, 12 N.J. Misc. 354, 171 A. 557 (1934); Southern Underwriters v. Weldon, (Tex. Civ. App. 1940) 142 S.W. (2d) 574; Manos v. James, 7 Wash. (2d) 695, 110 P. (2d) 887 (1941).

<sup>42</sup> United States v. La Favor, (C.C.A. 9th, 1934) 72 F. (2d) 827; Wicks v. Cuneo-Henneberry Co., 319 Ill. 344, 150 N.E. 276 (1926); Bartlesville Zinc Co. v. Fisher, 60 Okla. 139, 169 P. 476 (1916).

<sup>43</sup> Kickels v. Fein, 104 Ind. App. 606, 10 N.E. (2d) 297 (1937); Perringer v. Lynn Food Co., (Mo. App. 1941) 148 S.W. (2d) 601; Jenkins v. Charleston General Hospital & Training School, 90 W. Va. 230, 110 S.E. 560 (1922).

<sup>44</sup> Sim v. Weeks, 7 Cal. App. (2d) 28, 45 P. (2d) 350 (1935); Kramer v. Henely, 227 Iowa 504, 288 N.W. 610 (1939); Jameson v. Weld, 93 Me. 345, 45 A. 299 (1899); McGrath v. Fash, 244 Mass. 327, 139 N.E. 303 (1923); Perringer v. Lynn Food Co., (Mo. App. 1941) 148 S.W. (2d) 601.

<sup>45</sup> De Forge v. New York, N.H. & H. R.R. Co., 178 Mass. 59, 59 N.E. 669 (1901).

<sup>46</sup> Carlson v. Benton, 66 Neb. 486, 92 N.W. 600 (1902).

<sup>47</sup> *Illustration of sufficient verification*: "It is self evident that the physician could not state that the pictures were true representations of the objects beneath the surface of the body they purported to portray. X-ray photographs are generally recognized as

### B. *Interpretation by Experts—Generally*

Since laymen know little of human anatomy and are unfamiliar with X-ray images thereof,<sup>48</sup> a jury of laymen might easily be misled by an unexplained X-ray photograph.<sup>49</sup> Indeed, X-ray pictures of some parts of the body, such as the back and pelvic region, may tend to mislead not the layman alone but even a general practitioner of medicine.<sup>50</sup> Accordingly, one who qualifies as an expert in the interpretation of X-ray pictures may be permitted to take the stand and explain such pictures insofar as they are not understood by laymen.<sup>51</sup>

While medical doctors usually are qualified to interpret X-ray pictures, being a doctor of medicine does not in itself qualify one.<sup>52</sup> Indeed, it is not necessary for one to be a doctor of medicine in order to qualify, for a knowledge of human anatomy may be acquired to a high degree by a student of that subject although such person is not a medical doctor.<sup>53</sup> Therefore, upon a showing of experience and train-

scientific, trustworthy representations. Dr. Shaffer, who was experienced and skilled in the use of X-ray instruments, took the pictures, explained the position of the patient when the pictures were taken and his testimony clearly shows what portions of the body of the plaintiff are represented by the skiagraphs. We are of the opinion that there was sufficient foundation for the introduction of the pictures." *Kramer v. Henely*, 227 Iowa 504 at 506, 288 N.W. 610 (1939).

<sup>48</sup> *Judejko v. Chicago City Ry. Co.*, 166 Ill. App. 140 (1911).

<sup>49</sup> *Russell v. Borden's Condensed Milk Co.*, 53 Utah 457, 174 P. 633 (1918).

<sup>50</sup> See *Marion v. B. G. Coon Const. Co.*, 216 N.Y. 178, 110 N.E. 444, 445 (1915).

<sup>51</sup> *Pope v. Ryals*, 232 Ala. 260, 167 S. 721 (1936); *Sim v. Weeks*, 7 Cal. App. (2d) 28, 45 P. (2d) 350 (1935); *Call v. City of Burley*, 57 Idaho 58, 62 P. (2d) 101 (1936); *Cooney v. Hughes*, 310 Ill. App. 371, 34 N.E. (2d) 566 (1941); *Stamets v. Wilson*, 89 Ind. App. 403, 164 N.E. 300 (1938); *State v. Sullivan*, 230 Iowa 817, 298 N.W. 884 (1941); *Jerobeck v. Safeway Cab, Transport & Storage Co.*, 146 Kan. 859, 73 P. (2d) 1097 (1937); *United Rys. & Electric Co. v. Dean*, 117 Md. 686, 84 A. 75 (1912); *Whipple v. Grandchamp*, 261 Mass. 40, 168 N.E. 270 (1927); *Beard v. Turrutin*, 173 Miss. 206, 161 S. 688 (1935); *Spellmeyer v. Theo. Hiertz Metal Co.*, (Mo. App. 1925) 272 S.W. 1068, 1071; *Marion v. B. G. Coon Const. Co.*, 216 N.Y. 178, 110 N.E. 444, 445 (1915); *Eaker v. International Shoe Co.*, 199 N.C. 379, 154 S.E. 667 (1930); *Asch v. Washburn Lignite Coal Co.*, 48 N.D. 734, 186 N.W. 757 (1922); *Hall v. Nagel*, 139 Ohio St. 265, 39 N.E. (2d) 612 (1942); *Patrick & Tillman v. Matkin*, 154 Okla. 232, 7 P. (2d) 414, 415 (1932); *Schairer v. Johnson*, 128 Ore. 409, 272 P. 1027 (1929); *Missouri, K. & T. Ry. Co. v. Coker*, (Tex. Civ. App. 1912) 143 S.W. 218; *Russell v. Borden's Condensed Milk Co.*, 53 Utah 457, 174 P. 633 (1918); *Standish v. Newton*, 103 Vt. 85, 152 A. 41 (1930); *Manos v. James*, 7 Wash. (2d) 695, 110 P. (2d) 887 (1941); *Griffith v. American Coal Co.*, 75 W. Va. 686, 84 S.E. 621 (1915); *Mauch v. City of Hartford*, 112 Wis. 40, 87 N.W. 816 (1901).

<sup>52</sup> *Call v. City of Burley*, 57 Idaho 58, 62 P. (2d) 101 (1936); *Rawleigh v. Donoho*, 238 Ky. 480, 38 S.W. (2d) 227 (1931).

<sup>53</sup> *Whipple v. Grandchamp*, 261 Mass. 40, 158 N.E. 270 (1927).

ing in the interpretation of X-ray pictures, an osteopath may interpret pictures of various parts of the human body,<sup>54</sup> a chiropractor may explain X-ray pictures of the spine and related parts,<sup>55</sup> and a dentist may tell what is shown by X-ray pictures of the teeth and jaw.<sup>56</sup> But a person who qualifies only as an expert in the taking of X-ray pictures is not qualified to interpret them regardless of how many X-ray photographs he has made.<sup>57</sup> For example, in an action against a dentist for malpractice it is prejudicial error to permit a person who qualifies only as an X-ray operator, and not as an expert dentist, to interpret X-ray pictures of the plaintiff's teeth.<sup>58</sup>

In interpreting an X-ray picture a duly qualified expert may make demonstrative marks thereon, provided the general rules relating to marked photographs are complied with.<sup>59</sup> It is also permissible for an expert to use an illuminator (a box containing an opal or ground glass screen with a light behind it) to transmit light through the X-ray film as he demonstrates it to the jury.<sup>60</sup> If such a device is not available he may go with the jury to a window of the courtroom and explain the X-ray picture to them as he holds it up to the light.<sup>61</sup>

### C. *Weight and Sufficiency*

X-ray pictures are not always infallible and frequently are susceptible to more than one reading.<sup>62</sup> As a general rule, therefore, X-ray photographs are not conclusive but are to be weighed by the triers of fact like other competent evidence.<sup>63</sup> For example, it will not be assumed that X-ray pictures of the soft parts of the body are in any way conclusive evidence or that they compare in probative force or

<sup>54</sup> *Butler v. Armour Fertilizer Works*, 195 N.C. 409, 142 S.E. 483 (1928).

<sup>55</sup> *Jerobek v. Safeway Cab, Transport & Storage Co.*, 146 Kan. 859, 73 P. (2d) 1097 (1937); *Whipple v. Grandchamp*, 261 Mass. 40, 158 N.E. 270 (1927); *Agler v. Schine Theatrical Co., Inc.*, 59 Ohio App. 68, 17 N.E. (2d) 118 (1938); *Manos v. James*, 7 Wash. (2d) 695, 110 P. (2d) 887 (1941).

<sup>56</sup> *Schairer v. Johnson*, 128 Ore. 409, 272 P. 1027 (1929).

<sup>57</sup> *Sias v. Consolidated Lighting Co.*, 73 Vt. 35, 50 A. 554 (1901).

<sup>58</sup> *Saas v. Hindmarsh*, (App. Div. 1920) 184 N.Y.S. 467.

<sup>59</sup> See SCOTT, PHOTOGRAPHIC EVIDENCE, Vernon Law Book Company, § 637 (1942).

<sup>60</sup> *Chesapeake & Ohio Ry. Co. v. Kornhoff*, 167 Ky. 353, 180 S.W. 523 (1915).

<sup>61</sup> *Texas Employers Ins. Assn. v. Cheek*, (Tex. Civ. App. 1933) 63 S.W. (2d) 1103.

<sup>62</sup> *Whitton v. United Gas Public Service Co.*, (Tex. App. 1939) 187 S. 806.

<sup>63</sup> *Chicago City Ry. Co. v. Smith*, 226 Ill. 178, 80 N.E. 716 (1907); *Bruce v. Beall*, 99 Tenn. 303, 41 S.W. 445 (1897).



value with the actual conditions revealed by a post mortem.<sup>64</sup> Nor are X-ray photographs conclusive on whether or not a bullet lodged within a body is of a certain caliber.<sup>65</sup>

Conflicts in expert testimony interpreting X-ray pictures likewise are questions for the jury under ordinary circumstances.<sup>66</sup> So, the relative weight to be given to an interpretation of an X-ray picture by an ordinary physician, as compared to interpretations by roentgenologists with claimed greater training and experience ordinarily is a matter confided in the jury.<sup>67</sup>

<sup>64</sup> *Breslin v. Richfield Oil Corporation*, 124 Pa. Super. 43, 187 A. 822 (1936).

<sup>65</sup> *Mautino v. Piercedale Supply Co.*, 338 Pa. 435, 13 A. (2d) 51 (1940).

<sup>66</sup> *Sim v. Weeks*, 7 Cal. App. (2d) 28, 45 P. (2d) 350 (1935); *Cooney v. Hughes*, 310 Ill. App. 371, 34 N.E. (2d) 566 (1941); *Griffith v. American Coal Co.*, 75 W. Va. 686, 84 S.E. 621 (1915).

<sup>67</sup> *Sim v. Weeks*, 7 Cal. App. (2d) 28, 45 P. (2d) 350 (1935).