REPLY TO KELLS' COMMENT ON McCORMACK'S "PLEA
FOR A STANDARDIZED TECHNIQUE FOR
ORAL RADIOGRAPHY"¹

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On behalf of my collaborators and myself, I desire to thank Dr. Kells for the kind things he has said of us and our work in the criticism on pages 551-555 of this issue. Team-work, plus the advantages of constructive criticism and, at times, even of carping criticism "for differing so radically from the generally accepted facts," has so closely welded together our group of co-workers² that our objective is clear to us, but may not always be evident to our critics. We ask the indulgence of those of the members of the dental profession with whose opinions we appear to differ radically. Their objective and ours is presumably the same; the only differences are probably differences in the methods by which each group has undertaken to reach this objective.

We are fortunate, as a group, in being able to work together congenially for the common good, although there are great differences of opinion among us over many of the various questions that have arisen from time to time. The common ground on which we stand together is our unanimous belief in the importance of getting better radiography. At best, the radiogram has limitations that seem, at present, impossible to overcome. But the stimulus of working together as openminded men, to whom new ideas are not heresies, will, we hope, lead to better radiography than any we are doing now.

I hesitated a long time before publishing my paper on the shifting subject of radiographic technique. Often, in the past, I felt that a system had at last been worked out that was worthy of publication,

¹ Kells: JOURNAL OF DENTAL RESEARCH, 1920, ii, p. 551.

² Some of the members of the "group of co-workers" were named in the author's original paper on this subject: JOURNAL OF DENTAL RESEARCH, 1920, ii, p. 484.—(Ed.)

only to find later that the technique about which I was writing could be further improved, and that better results could be obtained by additional changes in procedure. This applies to what I published in this JOURNAL³ and which Dr. Kells criticises. Very recently, the installation of timing devices has improved my work so much, that I should like to recall some of the things I said in that paper about accurate timing. Fortunately, there is one consolation always—we invariably did the best we could.

There is one fundamental that is not subject to change, namely, the necessity for the installation of the best possible equipment. Before finally replying to my critics, I should like to learn the kind of equipment each is using, and something of the procedure with it.

Dr. Kells writes: "Many interesting (?) points will be ignored, for this (his) brief review can cover the 'high spots' only." This may also be said of any paper that deals with so great a subject as radiography in general. The only way I can hope to convince Dr. Kells that "certain didactic statements" are correct is to show him several thousand full-denture sets of radiograms where the results I have obtained can be demonstrated visually. The truth in these "didactic statements" has been proved by over four thousand entire-denture cases now in the hands of the dental profession of California. Many of these radiograms have been shown and the technique demonstrated to visiting dentists from various parts of the country, and also in class-work in Chicago. Further, the radiographic interpretations of a large percentage of these have been verified clinically, at operation and by bacteriological investigations.

No claim was made that the technique described by me is an exact, or an absolute one; but the mechanical manipulation of equipment, tubes, and dark-room procedure, is so standardized, and the fixed rules operate with such slight deviations, that the work would become purely mechanical if it were not for the physical variations in patients. It is the study of the physical variations in patients that makes the work particularly interesting. A knowledge of anatomy is required to enable one to apply the mechanical rules to these anatomical

³ McCormack: JOURNAL OF DENTAL RESEARCH, 1920, ii, p. 467.

variations. I have tried to simplify these rules so that only one factor, length of time of exposure, need be changed to overcome these physical variations.

Photography is a simple procedure to the amateur only. Those who have studied it most carefully realize that, by the trained eye and hand, one can get better and more uniform results in the dark-room than by the mechanical means of tank development. Tank development would be ideal if the jaws of all patients were of identical composition, but they are not. Hence, we rely upon the intelligence of the dark-room technician to overcome the variations of this factor by developing the negatives to a uniform standard density—an intelligence not obtainable with a tank.

In regard to preventing the occurrence of a radiographic shadow of the malar process over the apices of the upper molar teeth, I have to say that, if Dr. Kells will refer again to the top of page 476 of my paper, he will find there the statement that the patient should be placed in a horizontal position. The head is turned to one side and adjusted so that the malar process is uppermost, and the nose and the occipital protuberance are on a horizontal plane. The relative distance between the inferior border of the malar process and the crowns of the upper molar teeth is then ascertained by palpation. The height of the vault must be known, and its formation kept in mind. Position the film as nearly parallel to the long axis of the teeth as the vault formation will permit. If the vault is low and the malar process appears to be in the path of the rays, lower the head-rest enough to let the head incline slightly downward. This changes the positions of the teeth and malar process in relation to the tube; the malar process moves downward, but the teeth move up. With the tube thirty-six inches away, it is only necessary to produce a slight change in the relative positions of the two parts, to prevent the occurrence of a shadow of the malar process over the molar apices. This explanation amplifies my original statement, and gives to Dr. Kells the information he requests.

If the reproduction of radiograms after an interval of time is of sufficient interest to warrant the publication of a paper with half-tone reproductions of the radiograms, and photographic illustrations of the various procedures that must be used to explain the text, we

shall gladly prepare such a paper. But there are more important phases of radiography that should be considered first.

In his criticism affecting *fig. 1*, in *plate 1*, Dr. Kells is right. "Superimposition of the overlying muscular tissues" causes radiopacity, but the intermuscular spaces appear more radiolucent by contrast, especially at the angle of the mandible. Also lying above this region is the tongue and, posteriorly, the spine. Thus, there are many tissues of greatly varying densities superimposed upon this portion of the mandible. In this particular case, my records show that another plate and an intra-oral film were made to check the "phenomenon." In many cases of a suspected fracture at this point, several exposures should be made, because the "phenomenon" has been interpreted as a fracture. One case got insurance for over a year, until he was referred to me and several exposures were made that disproved the previous interpretation and diagnosis of fracture. Let me add my motto: "When in doubt, make additional exposures from different angles."

In reply to Dr. Kells' chief criticism, regarding the fact that *fig. 10* in *plate 2* is called a *vital tooth*, I wish to say that practically all our work is done on entire-denture cases; therefore, we see radiograms of many normal healthy teeth. Teeth that show no periapical changes, the pulp chambers of which have not been entered, and which exhibit no cavities or *deep* fillings, we have called *vital teeth* for want of a better term. Had we followed Dr. Kells' practice of making radiograms only of dead teeth, pulpless teeth, devitalized teeth, abscessed teeth, non-vital teeth (choose your own term), possibly we could not distinguish the appearance of a *vital tooth*.

Interpretation of radiograms must be accompanied by thought and reflection, not alone by the mere inspection of pictures. *Fig. 13* in *plate 3* illustrates this necessity. Definite periapical changes are shown at both apices. The pulp chamber does not appear to have been entered for purposes of treatment, the contacts appear to be good, the tooth does not seem to be elongated, thus eliminating traumatic occlusion as a cause; the only remaining cause would seem to be "deep fillings, probably involving the pulp chamber." For argument's sake, let us take that interpretation and follow it up clinically. One can drill into the tooth and probably get sensation.

One may even get sensation by various other tests. Which is the more valuable aid, the radiogram, or the clinical tests? That is one of the problems our group has tried to solve. So far, we think, the radiogram has the better of it. Many such teeth have been entered and treated, many have been *surgically* removed, so that the condition in the periapical region has been seen macroscopically and cultures have been made. The evidence gathered thus far shows that the radiogram tells the truth, except that the condition is usually more pronounced than is sometimes shown to be the case.

If Dr. Kells, who is a *dental consultant*, would differentiate between the terms *interpretation* and *diagnosis*, a great light might strike him. Interpretation calls the attention of the diagnostician to the changes from normal that the radiograms show; and the radiogram, plus the radiographer's interpretation, give radiographic findings. *These findings must be checked clinically and verified before a diagnosis can be made.* An important difference between Dr. Kells and myself is that his is a one-man job, from making the radiogram to operating the case, while my work is only one phase in that of a team consisting of several men. Therefore, if I make an interpretation of a "deep filling probably involving the pulp chamber," my opinion will be checked very carefully by others before it becomes a part of a *diagnosis by others*.

Regarding *fig. 17* in *plate 3*, I have to say that, in 1916, a number of dentists filled the canals of about twenty teeth (on my desk now) with the various available root-canal filling materials. All of these materials cast radiographic shadows except cotton, paraffin, and wood. (This was also done in the teeth of a dried skull, with the same results.) At the time, several dentists claimed that the radiograms had not disclosed the truth about their root-canal work; they were positive they had filled the canals to the apices. Later, it was found, when some of these teeth were extracted, that the canals had not been filled. As cotton, paraffin, and wood canal-fillings are no longer fads, we assume that a canal that is not shown by the radiogram to be filled must either contain one of these materials, or was not filled. *Although every dental consultant should be aware of this fact, probably very few are.*

Dr. Grieves' valuable paper,⁴ published in the same issue as the paper under discussion, shows that he is working toward the objective of our San Francisco group. He has classified teeth into six classes, the radiogram being of indispensable aid in the differentiation of his several classes. Suppose that by a refinement of technique, the very earliest pathological changes may be shown, almost at their commencement. Would Dr. Kells regard that as an intrusion on his chosen field as a dental x-ray diagnostician, or would he accept it as a very valuable aid and use it?

For over four years we have been making entire-denture sets of radiograms for the purpose of locating the minute sites of initial caries and the effects of malocclusion, in mouths in which there were supposed to be no devitalized teeth, and in which there were, in some cases, but few fillings. It has been the study of these apparently normal mouths that has shown us many things the existence of which we did not realize before, and for which it is now our regular procedure to look. In our opinion the radiogram is many times more valuable as an aid in locating these early changes than it is in finding an abscessed tooth that has become too diseased to save. It is a far greater satisfaction to locate the site of initial caries in an otherwise good set of teeth, than to discover a large, spectacular cyst. Many of the dentists in San Francisco are educating their patients to appreciate a well placed filling in a vital tooth more than the most modern of removable bridges. The patients feel that they have had "value received" if the radiograms showed some of these almost undiscoverable sites of initial caries.

The problem of locating the incidence of caries by means of radiograms is a very important one, that some day we may have the opportunity to discuss more fully.

If the illustrations in my paper are studied, the signs of many unfilled cavities will be seen in the teeth depicted there. In the upper left second bicuspid, in *fig. 7*, plate 2, the radiogram of which was made three years ago (and which, by the way, is one of my own teeth), a small area representing initial caries will be noted on the mesial surface. It is only recently that I stopped work long enough

⁴ Grieves: JOURNAL OF DENTAL RESEARCH, 1920, ii, p. 327.

to have the cavity attended to, and then not until it became painful. Caries on some tooth surfaces can be located as long as three years before the patient is conscious of any discomfort, and when the site might be overlooked in a clinical examination.

"A plea for a standardized technique" was published to help in attainment of the purpose that Dr. Kells so ably discusses in the three paragraphs preceding the last in his criticism. Physicians and dentists are justly demanding better radiography and more accurate radiographic interpretations, and it is incumbent upon radiodontists, dental x-ray diagnosticians, and commercial x-ray workers, to meet the demand. Just how we are going to do this is, at present, a personal matter with each of us. So far, each man has had to dig out the little he has learned by his own initiative and hard work. Possibly there is a way for those interested in radiography to learn from one another in a more satisfactory manner than through the agency of published discussions.

There is one difficulty with radiography, namely, that when one begins to talk or write about it, it is hard to stop. I am conscious of this difficulty now, so I shall say "Good-night, Dr. Kells," and express the hope that we may meet at an early date, where we can spend time enough, in front of an illuminating box in the study of radiograms, to become better acquainted with each other's work and conclusions.

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