ORTHOPEDIC EVALUATION

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The Howard University Department of Radiology was pleased to participate in the preliminary investigation of the Lixiscope. I have in the past performed athletic team doctor type functions, where you are actually on the field, and a member of the team may be injured, and the coach wants to know, can he play, does he have to go to the hospital, does he need ice, exactly what would you do? In high school sports and college sports, in particular, the majority of the fields are just simple fields, and there are no electronic facilities available. However, the Redskins, the Colts, and all the other pro-football teams have X-ray facilities on the premises, so they have no problem. But for youngsters, and 99 percent of the injuries at that level are going to be benign injuries, either sprains or soft tissue injuries, they are rarely serious enough to send anybody to the hospital. A portable fluoroscope would be ideal to, first of all, help alleviate anxiety and to progress and speed up the treatment of the patient.

The Lixiscope was first brought in for evaluation less than a month ago, and in an effort to prepare as many patients as quickly as possible, arrangements were made to have patients from the emergency room and from the Orthopedic Clinic come to the X-ray Department. Here, a team of observers first clinically, and then with the Lixiscope, examined the patient. These were all trained radiologists who spend all day looking at bones, so perhaps any bias is understandable. In this evaluation, the radiologist examined the patient with the Lixiscope, formed a separate clinical opinion, and then the patient proceeded to have a routine radiograph of the part in question. The initial studies were limited to the hand since the Lixiscope is not developed sufficiently to do knees or even ankles, and the opportunity to examine a foot did not arise.

The other problem that became immediately apparent was the acutal reproduction of the initial impression under the Lixiscope. Figure 1 shows a skeleton. There are no soft tissues, and a dense structure that is actually a wire that holds the bone together can be seen. The picture shows the joint space, a toe, and the contical margin of one of the bones of the toe. The light areas in the picture are a part of the problem of using Polaroid film. The emulsion is much less inferior to X-ray film even, and much less inferior to other recording media.

In the picture the Trabecular pattern can be seen. This pattern is the dark lines, which are actually the densest portion of the bone. The size is magnified on the order of two times magnification, which is another limitation of the camera. This picture is actually twice the size of the image that can be seen in the Lixiscope, and it has about a one-inch diameter orifice. It has one basic limitation in that the part that can be examined is of a small area.

Figure 2 shows the hand and the beginning of the wrist of a patient. The picture shows an abnormality in the base of the phalanx (finger). From the picture, one can follow the contical margin to where there is a break, whereas, by following any of the other contices, which is just the outside edge of the bone, it is very sharp and very distinct. There are no projections or evidences of what this is—a fracture. Figure 3 is a close-up of that same finger.

Figure 1. Photograph of a Skeleton

Figure 2. Photograph of Patient's Hand and Wrist

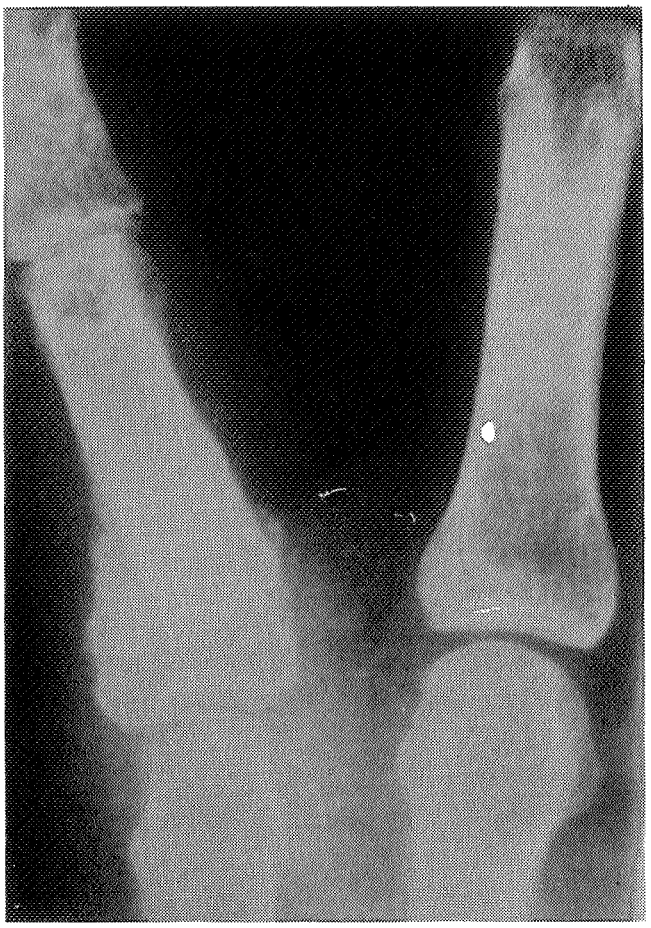

Figure 3. Close-Up of Patient's Finger

Figure 3 is a photograph of much greater detail. In this picture, one can see the thumb to the side, the wrist, the fifth finger, the little finger, and the joint space clearly. The "contical margin" can be followed to a black line, a denser black line, and then another black line. The fracture of the bone can be seen. Some evidences of new bone, or callous, can be seen which indicate healing of the fracture. This fracture is about a month old, or maybe older than that, and the patient has no complaints at this time of pain; but there is still some swelling.

The Polaroid image in Figure 4 accompanied the initial clinical evaluation of this patient's fracture. The base of the bone is off of the picture, but the beginning of contical margin can be seen. In this picture, one must reverse the images so that things that were white before are now black, and the white line which can be seen was the black line on the fracture. The callous, the indication of healing, can be seen and the fracture is evident.

This is very gross, and to an untrained eye, probably doesn't mean a great deal, but it must be realized that the resolution of the Lixiscope is probably on the order of five times better than the Polaroid picture. The radiograph is another magnitude greater than the Lixiscope.

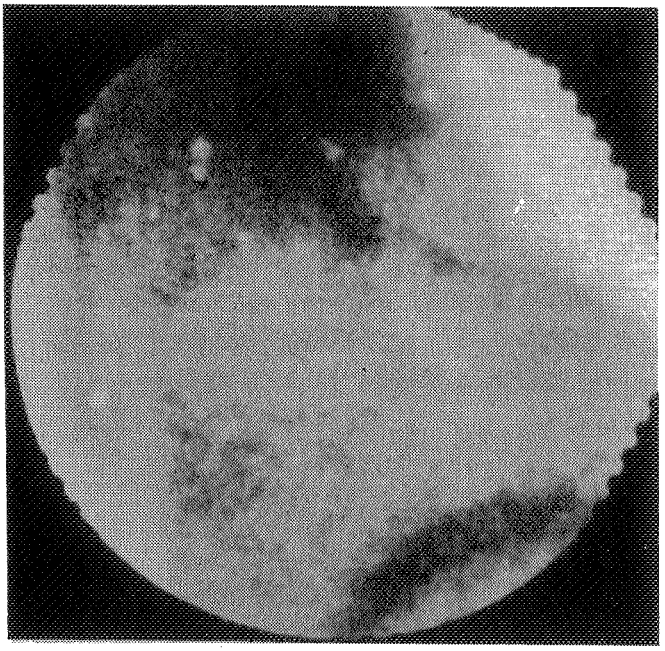

Figure 4. Polaroid Photograph of Patient's Hand with Fracture

Figure 5 shows the hands of another patient. This is an even more subtle finding. In this picture some abnormality can be seen at the base of the tip of the finger. The so-called "ungal tuff" of the finger is abnormal.

A different projection of the same finger is shown in Figure 6. In this picture a projection of some abnormality at the tuff can be seen. This patient was a construction worker who closed his finger in the door of the truck. He has considerable pain and swelling at the fingertip. With the Lixiscope, his particular injury was not readily apparent. Based on clinical examination, it was believed he had a fracture. With this specific index of suspicion and knowing that the fingertip was turning blue, it was obvious that something was wrong. However, with the Lixiscope, all that was apparent was that there was a loss in the normal part of the bone; it was disorganized. If you imagine a pattern of lace of a fine handkerchief, you can imagine the lace being overlapped upon itself, and you don't have a clear image anymore.

Figure 7 is a Polaroid picture of just that area of bone where there is a suggestion of a clear line and a dark line. It looks disorganized and doesn't have the appearance of a definite fracture. But certainly, this patient deserves the benefit of further follow-up and of a standard radiograph and treatment. What this bears out is that if the Lixiscope is going to be used as

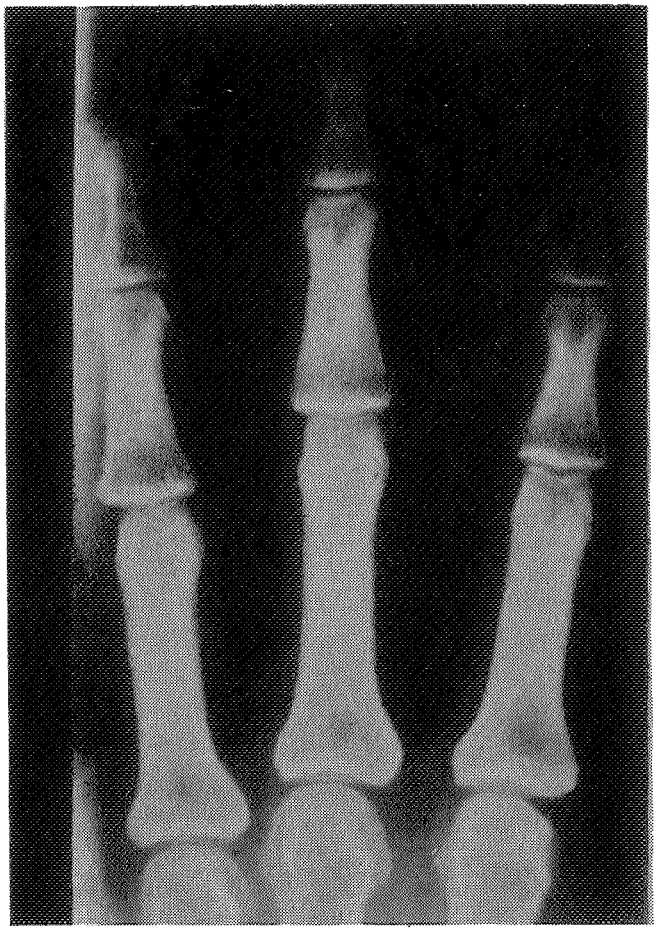

Figure 5. Photograph of Patient's Hand Showing Abnormality

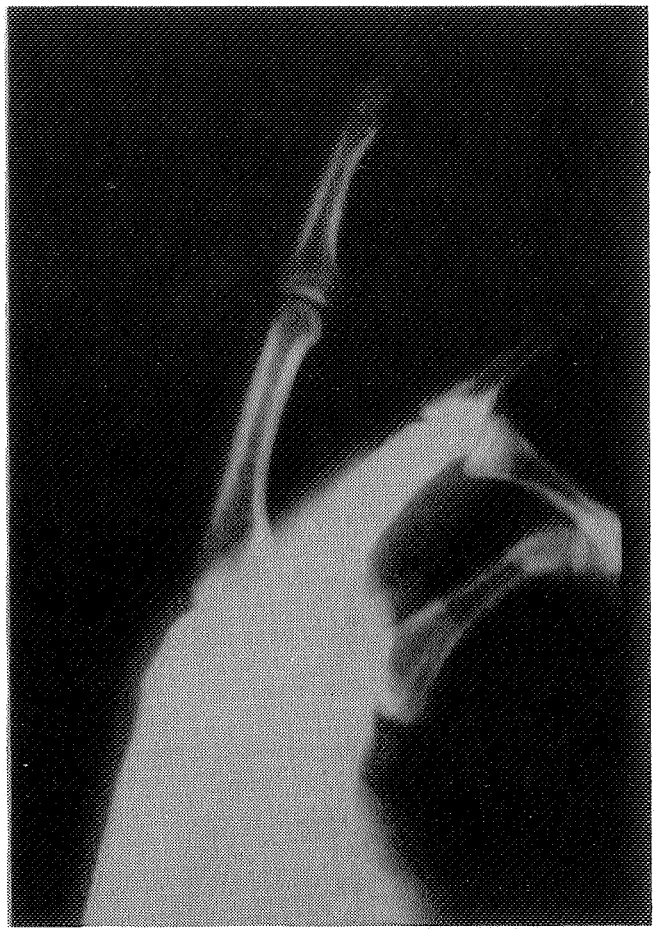

Figure 6. Different Projection of Same Finger

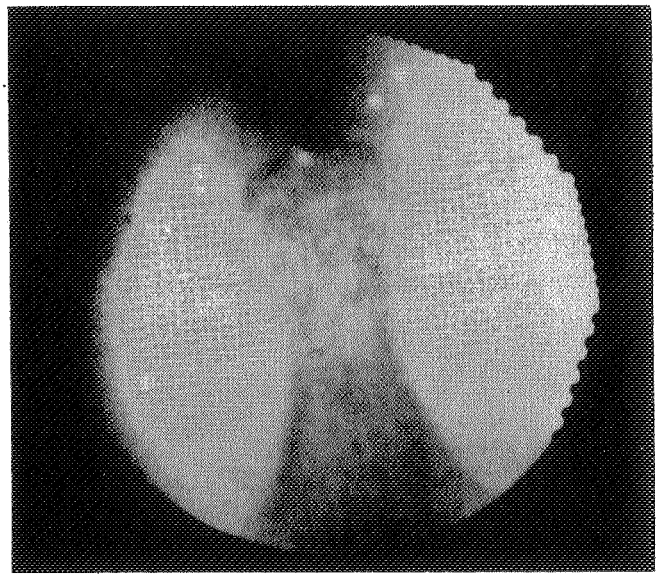

Figure 7. Polaroid Photograph of a Bone with Possible Fracture Line

a screening device, it is effective. At least this patient wasn't sent home from the emergency room without further therapy. From this, it looks like the specificity of the Lixiscope is probably going to be pretty good.

Figure 8 is a photograph of an individual who had a soft tissue injury to his hand. He had a laceration or a cut, which had been stitched. He was sent to the Radiology Department to make sure there was no involvement with the bone or evidence of a fracture. Under the Lixiscope, it was observed that he had an irregularity. In the picture, a very, very subtle evidence of a projection can be seen along with a little white line and then the suggestion of some abnormality in the cortex. Clinically, it was believed that the chances of a fracture in this area were pretty slim, because the injury to the hand was the actual laceration. It didn't show on the X-ray, but it was believed that he may have had an old fracture because of the abnormality.

Figure 9 shows a close-up of the same area, and as suggested, some time in the past he had some sort of an injury. The Lixiscope was actually able to pick up that little area of bone on the examination.

Figure 10 is a picture of that bone, and it corresponds to some injury he had in the past. On questioning the patient, he admitted that he had boxed as a younger individual and probably broke his finger. It was such a small injury that he never had any treatment, and the injury healed up.

This small number of cases and the small amount of experience Howard's Radiology Department had with the Lixiscope certainly justifies further evaluation as well as some clinical trials.

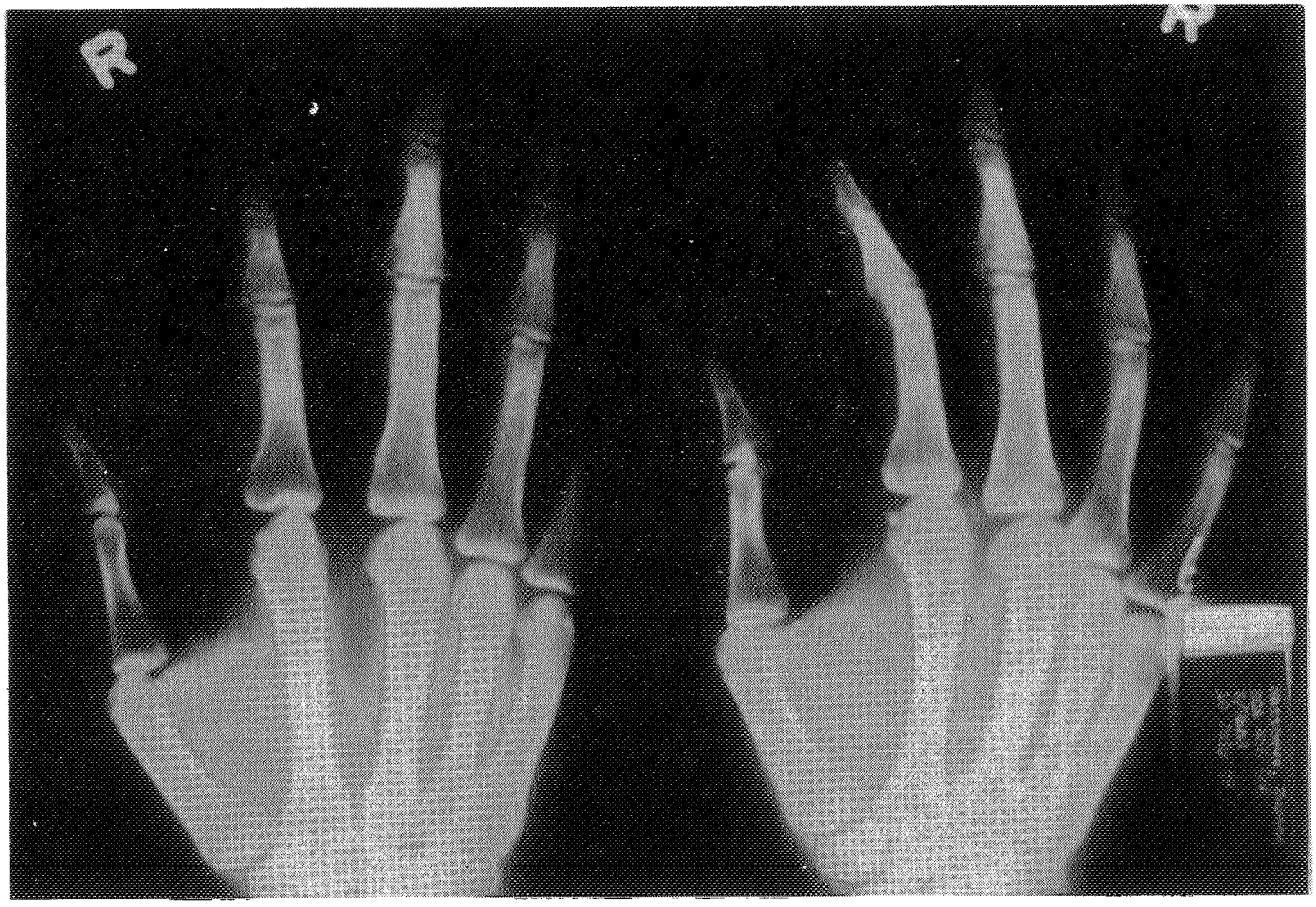

Figure 8. Photograph of Soft Tissue Injury to Hand

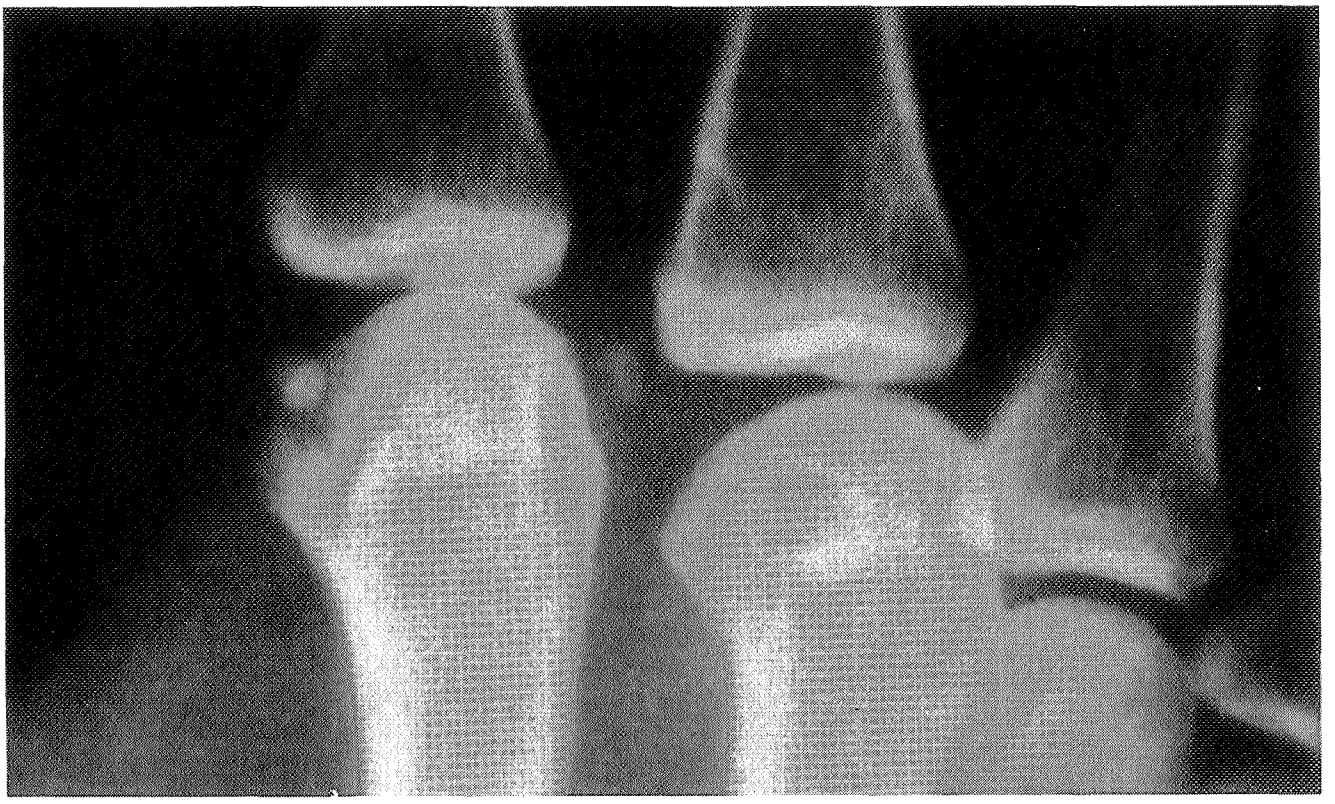

Figure 9. Close-Up of Soft Tissue Injury

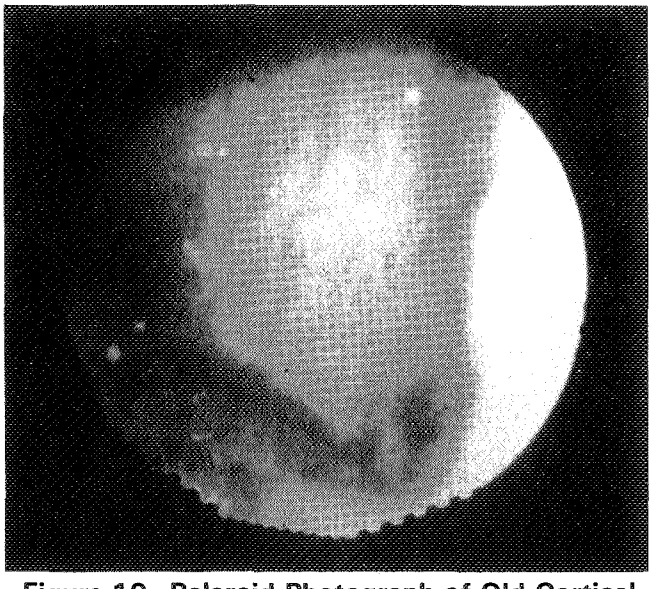

Figure 10. Polaroid Photograph of Old Cortical Injury

The advantages of the Lixiscope are its portability and its size. It can't weigh more than 10 pounds. Furthermore, the fact that it can be used in remote areas and even in easily accessible areas where there is a need of time and movement of patients makes it advantageous. Certainly, it has no more radiation hazards than a standard X-ray.

Its disadvantages at this point in time are its small size and its lack of ability to study large areas. There is currently some work being done to alleviate these problems.