

A NEW INSTRUMENT TO SUPPORT EXAMINATION OF DISTAL RADIUS ON WRIST RADIOGRAPH

Nguyen Anh Sang*, Tran Quoc Doanh**, Dang Hoang Anh*, Le Gia Vinh*,
Doan Van Khue**, An Quang Vu**, Nguyen Dang Huy**, Nguyen Dang Khoa***

ABSTRACT

Objectives: To construct an instrument that supports wrist position control according to a number of shooting angles in anteroposterior and lateral position during X-ray examination.

Materials and methods: Term such as criteria for evaluating wrist X-ray films, current technical status, some concepts about posture have been scientifically researched. Based on those things to provide research directions and design tool samples. A male volunteer, 36 years old agree to participate in the study, X-rays were taken in an anteroposterior and lateral position for investigation. **Results and Conclusion:** Initial evaluation shows that this tool is easy to use and only takes a little time to get used to the adjustment operations. The benefit that the device brings is that it helps stabilize the wrist position during X-rays, helping to adjust the angles within the range of motion of a normal person, produces more accurate wrist X-ray results, without having to take multiple scans, saving effort, machine wear and tear costs, creating practical benefits for patients, medical staff, researchers and hospital.

Key words: Wrist, instrument, support, X-ray.

I. INTRODUCTION

Wrist X-ray is a routine, effective paraclinical test, and is commonly deployed at treatment levels. A standard protocol for

wrist X-rays is necessary to ensure correct positioning and the ability to analyze the resulting images. Immobilization of the wrist position during X-rays can make the projections uniform at one angle and comparable by the application of a device that controls the position of the wrist at the location you want to survey.

In general, the available tools satisfy the function of resting the arm, or taking a certain position. When the first X-ray results are incorrect, correction is very difficult because there is no means to support accurate measurements, so the results are not as expected.

From there, conduct research with the goal of “Constructing an instrument that supports wrist position control according to a number of shooting angles in anteroposterior and lateral position during X-ray examination”.

II. MATERIALS AND METHODS

The initiative is in the field of applied tools for medicine, specifically the initiative refers to devices that support wrist position fixation to serve in wrist X-ray work in people with indications.

2.1. Criteria for evaluating wrist X-ray films

According to some authors, the standard for evaluating a satisfactory X-ray film of the wrist (Figure 1) is to see the entire wrist, including the metacarpus, carpal bones and the lower end of the two forearm bones and on the film. Lateral position of ulna and radial bones stacked on top of each other [1],[2].

* Vietnam Military Medical University

** Military Hospital 175

*** Military Hospital 121

Responsible person: Nguyen Anh Sang

Email: dr.anhsang@gmail.com

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Figure 1. Illustration of standard wrist X-ray film

a: Anteroposterior position; b: Lateral position

“Source: Measurements in Musculoskeletal Radiology, 2020” [1]

2.2. Current technical status

To be able to measure accurately, X-ray film must meet standards. However, the radiographic results are not always as required, only meeting the basic observations about the continuity of the bone cortex, and the angles and distances cannot be measured because of the wrong shooting position, or due to not being properly fixed during shooting (Figure 2).



Figure 2. Illustration of an X-ray film of the wrist in a lateral position that is not up to standard due to incorrect hand placement during the scan

a,b,c,d: Lateral position film of ulna and radius do not stack on top of each other

“Source: Author's research materials”

Scientific research is also limited due to incorrect shooting positions, film results do not meet the standards for measurement and evaluation, while shooting cannot accurately capture the wrist position at angles and distances need to be researched.

2.3. The self-made device

The purpose of the invention is to overcome the limitations mentioned above, to propose the application of a device to support wrist position fixation in wrist X-rays to stabilize the wrist during the scan, and the patient being photographed does not have to worry about holding their hand to error-free, aligning angles within the normal person's pronation and supination range of motion, creating practical benefits for patients, medical staff, and researchers.

This tool consists of a rotating frame attached to a shaft ring holder fixed to the base frame, combined with components such as a lifting frame, forearm holder, and a device to stabilize the wrist of the person whose wrist is being X-rayed. And during the shooting process in each straight and tilted film position, the technician can adjust the shooting angle so that the results match the standards.

The tool's parts are made of aluminum because the material is easy to find, does not belong to the toxicity group according to IARC, is corrosion resistant, easy to process, light, durable, easy to clean, and replace when is damaged.

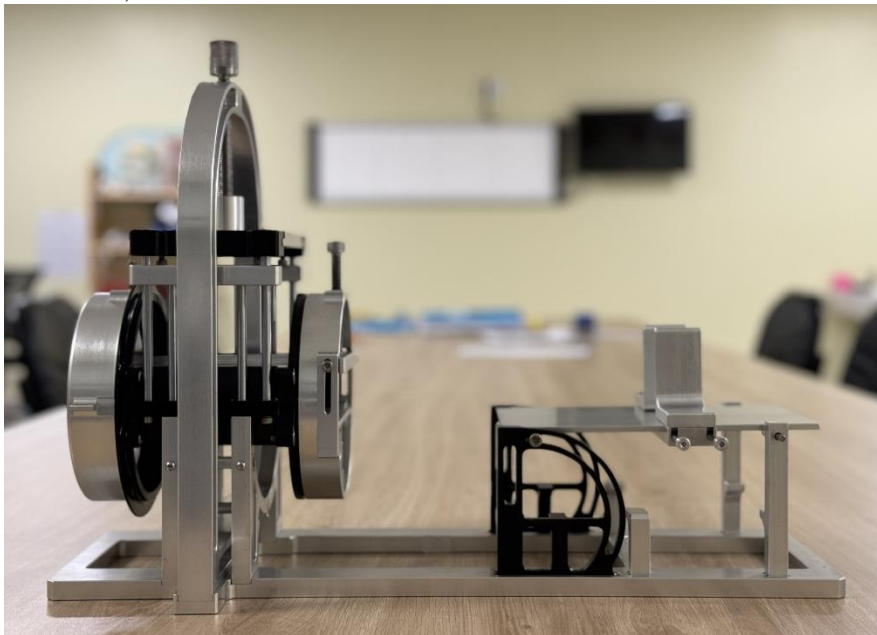


Figure 3. Self-made device to help control wrist position

“Source: Author's research materials”

2.4. Some concepts about posture

Anteroposterior position: The model places his or her hand on the support frame (Figure 4), put hand on the tool's hand holder, and forearm on the tool's forearm holder, fix the hand and forearm in a palm-up

position, hand holder and forearm holder straight on the same plane, midway between the line joining the ulnar styloid process and radial styloid process in the center of the sensor plate.

Lateral position: The model places his or her hand on the support frame (Figure 4), The technician stands opposite the rim surface with the measuring line, gently holds the patient's hand, and rotates the rotating frame to the angle to be surveyed. Use the small plate of the milling device to align the hand so that the hand is tilted with the fingers straight, the inner border of the wrist - hand (ulna side) is on the same plane as the large plate, the ulnar styloid process is in the center of sensor plate.

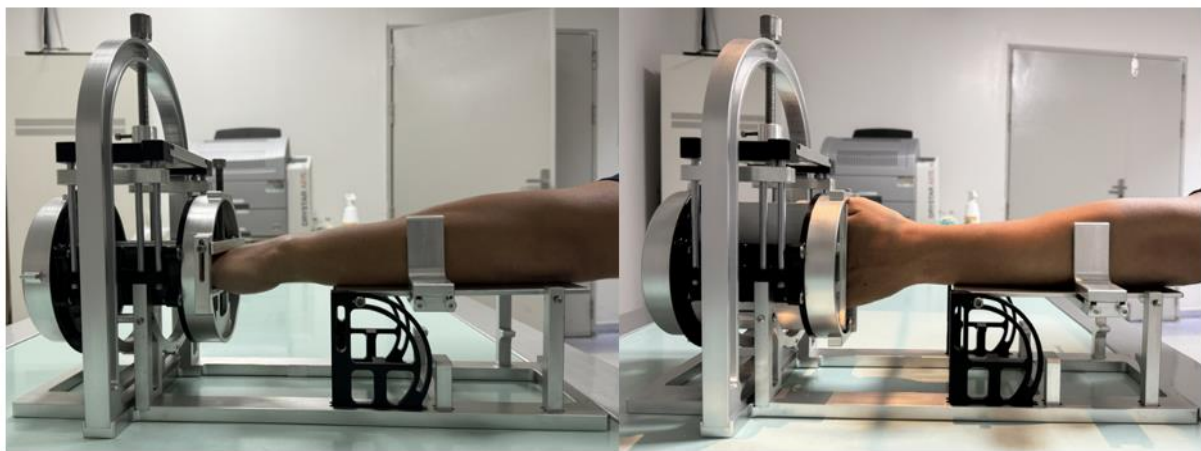


Figure 4. X-ray hand position with the support of a wrist position control device
“Source: Author's research materials”

The device will stabilize the wrist and control the shooting angles with a rotating frame equipped with a protractor. The wrist will be kept still while the X-ray is taken, and X-ray results will be obtained in the anteroposterior and lateral positions. (Figure 5).

If the X-ray results in one or both imaging positions are unsatisfactory, the position of the wrist will be adjusted and the X-ray will be repeated.

III. RESULTS

The tool is designed by the author, has overall and detailed technical drawings, is

2.5. X-ray examination of the wrist on a male volunteer

A man, 36 years old, fully capable of civil acts, history: No sprains or fractures in the wrist area; There is no wrist degenerative disease or wrist cartilage damage; There are no traces of surgical intervention on the forearm, wrist, or hand. Volunteer to participate in an X-ray survey of the wrist area. The survey arm is placed in a self-made device that supports control of wrist position (Figure 3).

manufactured in a quality mechanical workshop, is allowed to produce tools, the components are fully calculated, refer to the size measurements of domestic medical literature to reduce the size to suit Vietnamese people. The author is applying for a patent for this tool at the Intellectual Property Office of Viet Nam.

The solution has been applied in practice on patients. The device is being tested by a group of healthy volunteers and patients with wrist problems are being referred for wrist X-rays. One device can be used for many patients, customized to many sizes of forearm and hand. The tool is simply

manufactured and assembled, and can be conveniently disassembled for cleaning or replacing parts when is damaged, can be applied when taking routine scans or taking pictures during surgery to check the results of osteosynthesis process. The tool can be popularized for deployment in military and civilian hospitals.

In the X-ray results of (Figure 5), compared with the standard wrist X-ray (Figure 1), we see that the tools applied in real life have begun to be more effective when taking X-rays of the wrist without supporting tools (Figure 2).

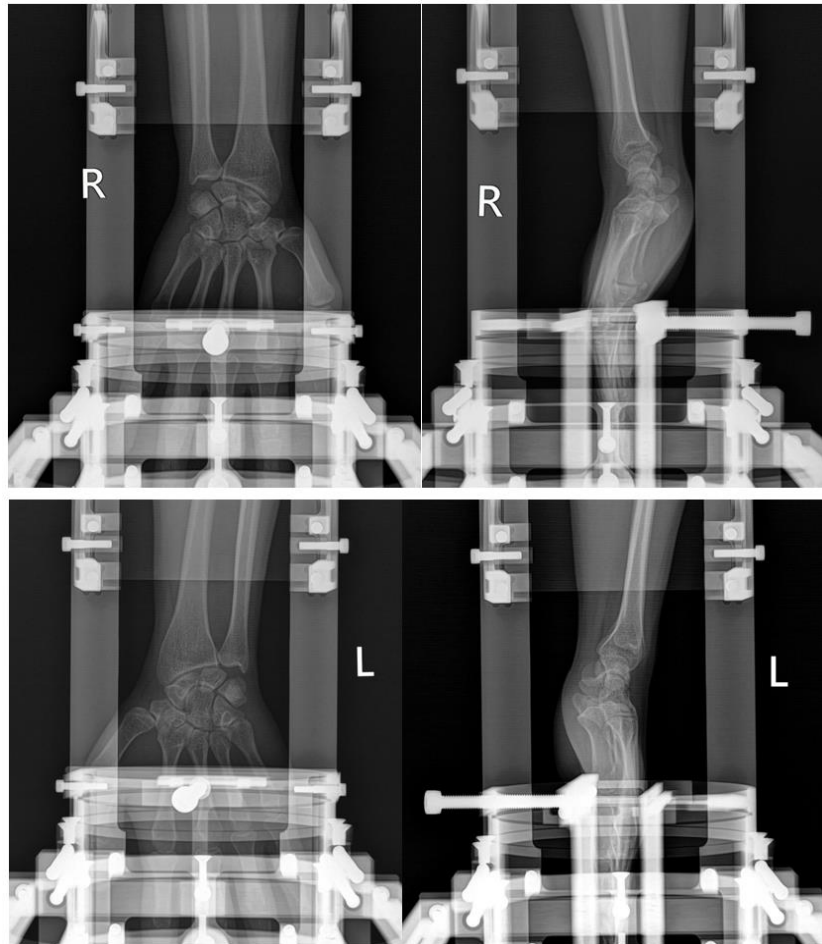


Figure 5. X-ray results with the help of a wrist position control device
“Source: Author's research materials”

IV. DISCUSSION

At 0° position, on anteroposterior film, the bones of the wrist can be easily identified and measured. But just a small rotation angle from 5° to 10° can change the size of the wrist, a component of the bones in the wrist. To be able to measure accurately, X-ray film

must meet standards. However, the radiographic results are not always as required, only meeting the basic observations about the continuity of the bone cortex, and the angles and distances cannot be measured because of the wrong shooting position, or due to not being properly fixed during

shooting. Scientific research is also limited due to incorrect shooting positions, film results do not meet the standards for measurement and evaluation, while shooting cannot accurately capture the wrist position at angles and distances need to be studied.

In 1990, Larsen C. F., Stigsby B., Mathiesen F. K., and colleagues [3] announced a new device for standard radiography (Figure 3). This publication has demonstrated the importance of correct wrist fixation to determine measurement angles at the wrist bones. The authors' published device allows adjusting the wrist position when taking X-rays. It can be seen that the device can help increase accuracy when taking films, but there are also some limitations that the author also mentioned such as not being able to examine patients lying in bed, or if the sensor plate is larger than expected, or the X-ray machine is old and cannot be rotated securely, it will be difficult to take an X-ray. Although the angle can be adjusted, it is only a subjective estimate and cannot accurately measure the angle.

In 1995, Nakamura R., Horii E., Imaeda T. et al [4] presented a technique to obtain a standard lateral view of the wrist using a stand. Each wrist is projected individually. In 1999, Lundy D.W., Quisling S.G., Lourie G.M et al [5] presented an X-ray frame built to help obtain 22° inclined X-ray images.

This study clearly shows the importance of stabilizing and controlling wrist posture. Changes in size and angle between the bones in the wrist that occur when X-raying the wrist are very important. Among them, the most commonly detected error is that the lower end of the radius and ulna do not overlap after returning the results. Significant changes in the size and angle between the

bones during unsatisfactory imaging results will cause difficulty in controlling lower radioulnar joint instability in lateral radiography.

V. CONCLUSION

The tool is completely self-made and is being published for the first time. There is no similar product in the country at the time of reporting. This self-made tool has a mechanical structure, many assembly structures, is flexible, convenient to preserve and replace when damaged, without having to replace the entire tool. The device has wide applicability and can be deployed in military and civilian hospitals.

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