Digital Hand-Wrist Radiographs for Evaluating Skeletal Maturation

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The use of hand-wrist radiographs for evaluating skeletal maturation was first described by Fishman in 1982.[1] This information can be helpful in planning orthodontic and dentofacial orthopedic treatment and in determining the optimal timing of extraoral traction, functional appliances, and surgical procedures.

With a conventional cephalometric x-ray unit, the patient's hand can easily be positioned on the stationary cassette before the film is exposed (Fig. 1). A digital system is more difficult to use because the sensor is in constant motion during the exposure. This article shows how to obtain digital hand-wrist images that can be used to evaluate skeletal maturation.

Procedure

1. Prepare the cephalometric unit for an anteroposterior image by rotating the cephalostat 90° from the conventional lateral ear-rod position.

Fig. 1 Hand placement on conventional, film-based cephalometric unit. (Although left hand is normally x-rayed, right hand was used in these photographs because of patient's physical limitations).
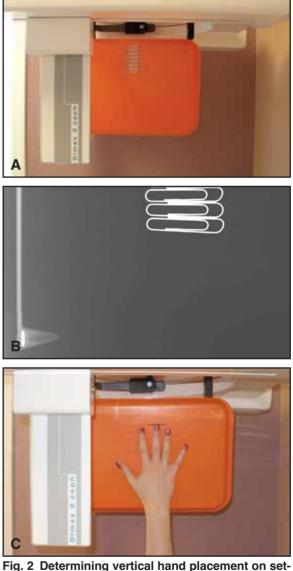

Fig. 2 Determining vertical hand placement on set-up tray. A. Paper clips positioned in column at top edge of tray. B. Test image shows lowest three paper clips, indicating that top of hand should be placed just beneath fourth paper clip from top of tray. C. Hand placed on tray with tip of middle finger at horizontal line drawn below fourth paper clip.

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2. Attach a large, flat, metal-free setup tray* to the ear rods with tape so that the bottom of the tray faces the sensor, with the ear rods at the outer edges of the tray.

3. Determine the appropriate vertical hand placement. Because cephalometric units are not standardized, the hand position must be initially calibrated. Affix a column of about seven paper clips to the upper part of the tray, beginning at the top edge (Fig. 2A). Then expose a test image to determine where the top of the hand should be placed (Fig. 2B). In the sample image produced with our unit, only three of the seven paper clips are visible. Using a permanent marker, draw a horizontal line on the tray just below the first paper clip that is not visible on the test image (in this case, the fourth paper clip from the top). The distance from the top edge of the tray to the horizontal line can be replicated on other trays for future images with the same unit.

4. Remove the paper clips from the tray and place the patient's hand on the tray, centered between the ear rods, with the tip of the middle finger touching the horizontal line (Fig. 2C). Instruct the patient to apply slight pressure on the tray for stability.

5. Adjust the voltage, amperage, and other exposure settings as needed. Consult the manufacturer if required.

6. Make the exposure (Fig. 3).

Discussion

Because of advances in orthodontics, the skeletal information provided by hand-wrist radiographs is even more valuable today than when the technique was first described 25 years ago. In orthopedic treatment, accurate prediction of growth patterns and rates provides optimal timing for the correction of skeletal imbalances.

Using the procedure described here, the orthodontist can easily take digital hand-wrist radiographs, which can be manipulated electronically with appropriate software. The ability to alter their contrast, zoom, and other features makes the assessment of skeletal maturity more accurate and efficient than with film radiographs.

REFERENCES

1. Fishman, L.S.: Radiographic evaluation of skeletal maturation: A clinically oriented method based on hand-wrist films, Angle Orthod. 52:88-112, 1982.

Fig. 3 Resulting digital hand-wrist radiograph.