Manual Compression Device for Fluoroscopy[1]

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A device for manual compression and palpation during supine fluoroscopy has been designed. It enables effective use of the physiologic grasping and lever force potentials of the hand and wrist. The device permits optimal fluoroscopic palpation and compression techniques and prevents direct exposure to the lead-gloved hand.

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PROPER fluoroscopy, whether it is performed with single- or double-contrast techniques, requires judicious use of both palpation and compression to achieve optimal diagnostic results (1–5). Palpation permits the examiner to determine the pliability and mobility of the organ being imaged, to move loops of bowel that lie over and obscure the organ of interest, and to straighten and visualize redundant loops of bowel. Compression permits the examiner to vary the amount of barium in a hollow viscus, enabling subtle mucosal and mural details to become evident. Occasionally, compression is helpful in limiting respiratory excursion in patients unable to cooperate in the examination. Obese patients may be "thinned" by compression just enough to improve the radiographic detail on crucial spot images.

Although no one disputes the value of compression and palpation, little attention has been given to the mechanism of performing these techniques. This lack of description may exist because many older radiologists used the lead-gloved hand to accomplish compression and palpation and were comfortable with this method. Modern textbooks discourage this practice (6). Many devices have been developed to permit palpation while keeping the gloved hand out of the primary beam.

With the exception of modern remote-control fluoroscopy units, fluoroscopy units with compression devices mounted to the fluoroscopy carriage are usually coupled with the four-on-one imaging modality. Thus, the entire fluoroscopic carriage is moved for palpation, thereby eliminating the subtle "feeling" aspect of palpation. Compression can be applied only at the center of the imaging field, and the application of compression may not be possible in some patients in the steep oblique position. Experienced fluoroscopists know that certain lesions are depicted only when tangential oblique pressure is exerted on a viscus; this is not possible with devices mounted on conventional non–remote-control fluoroscopic units.

Because of the fear of minimal radiation exposure, even to the hand covered with a lead glove, many specially designed and impromptu hand-held devices have been used to permit palpation and compression while the gloved hand is kept out of the field of the primary beam. To my knowledge, all of these devices must be grasped by the fingers; the more force applied by the examiner, the more stressed and fatigued the fingers become. The large, cumbersome balloon paddle, well designed for prone compression, is poorly applicable to supine fluoroscopy.

Materials and Methods

Device.—A new compression spoon (F Spoon, Dover, Mass) was designed with a handle that permits maximal physiologic grasping and pressure application during supine fluoroscopy with conventional units (Fig 1). One plastic projection attached at approximately a right angle to the handle of the spoon fits into the palm of the hand, and the device can be grasped by the hand. A second projection fits over the dorsum of the wrist (Fig 2) and serves as the second lever point. These two projections form the shape of an F.

The device is made of radiolucent, durable plastic with two small lead markers placed 1 cm apart to permit estimation of the size of the lesion (Fig 3).

Method of use.—Downward pressure by the palm with fixation or upward pressure by the wrist will exert a lever force on the compression spoon. The peak momentary pressure that can be applied with this device varies according to the strength of the user and ranges between 15 and 35 lb (6.75 and 15.75 kg) of pressure. This pressure not only exceeds that achieved with all other current hand-held compression de-

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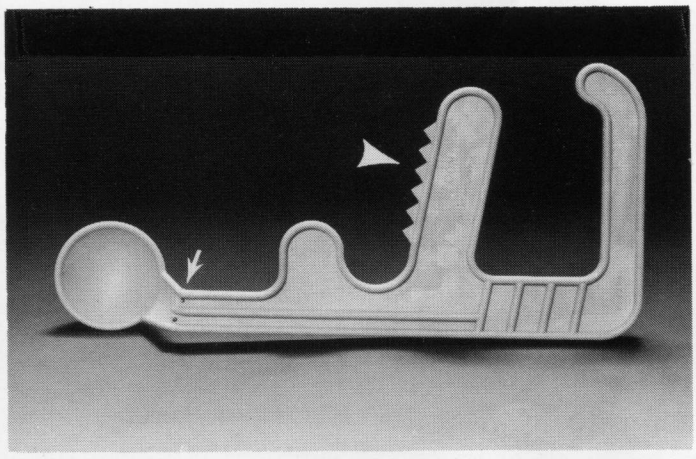


1.

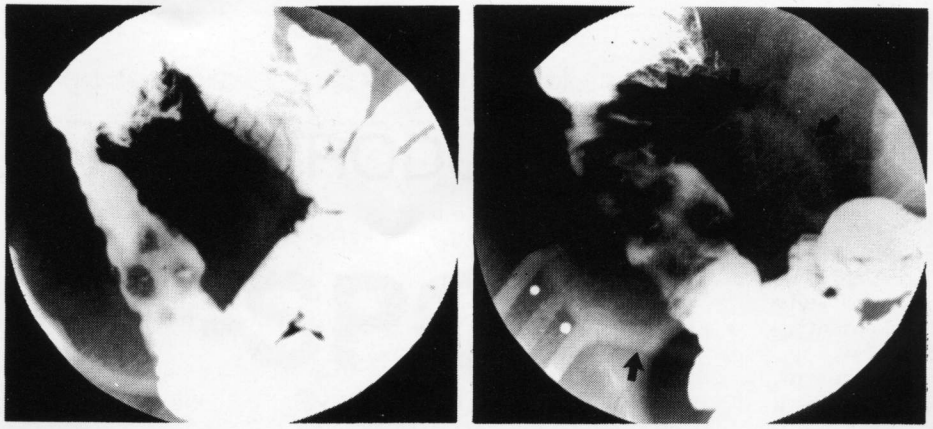
2.

Figures 1, 2. **(1)** Compression device. Arrow points to 2-mm lead markers placed 1 cm apart, adjacent to the compression spoon. Arrowhead points to the serrated projection, which is gripped in the palm of the hand. **(2)** The device in use with the projection over the wrist permitting leveraged compression. The fluoroscopy carriage has been raised to permit photography.

vices but approximates that possible with the fingers of the gloved hand. This can readily be confirmed by comparison with the use of a bathroom scale.

A projection on the undersurface of the device can be grasped by the thumb. This permits a clenched-fist grip and permits angled compression in the oblique position, duplicating that previously possible only with the gloved hand.

Radiation measurement.—Radiation exposure to the hand when the device is used was measured with a digital dosimeter (Keithley, Cleveland) during fluoroscopy. A pelvic phantom (3M, St Paul) was used to approximate a patient of average size, and the ion chamber was taped onto a lead glove. Compression was simulated with the F-shaped spoon, an 8-inch-long (20-cm-long) wooden spoon, and the glove alone. The exposure rates were 2.8 mR (0.72 μC/kg) per minute with the F-shaped spoon, 5.2 mR (1.34 μC/kg) per minute with the wooden spoon, and 28.6 mR (7.38 μC/kg) per minute with the lead glove.



a. b.

Figure 3. **(a)** Spot image (100 mm) of the ileum proximal to an ileal ascending colon anastomosis shows the effect of graded compression. With only minimal compression, four aphthous ulcers are identified in this patient with Crohn disease. **(b)** With firmer compression, numerous additional ulcers and their linear character are revealed. The 2-mm metal markers placed 1 cm apart permit appreciation of fineness of ulcers. Only the edges of the compression spoon are faintly evident (arrows). The remainder of the compression region of the device is radiolucent.

Discussion

The use of the wrist as a lever permits the effective length from the lever arm to the compression spoon to be longer than that with compression devices grasped only with the fingers. Therefore, with proper fluoroscopic technique and collimation, fluoroscopy and spot imaging are possible without exposure of the lead-gloved hand to the primary beam. Furthermore, the projection grasped by the hand has a serrated edge, which serves both to remind the examiner to wear a lead glove and to enable a firm grip while the glove is worn.

Compression of the erect patient with the device is possible but less comfortable than compression with the machine-attached cone. The device was not designed for and is not satisfactory for prone compression, which requires either an inflatable balloon device or a bolster pillow.

Optimal use of fluoroscopy requires the judicious use of palpation and compression. Few residents today are comfortable palpating directly while wearing a lead glove. The balloon compression paddle provides the best practical compression of the abdomen with the patient in the prone position. However, with non–remote-control fluoroscopic units and supine imaging, I believe the F-shaped compression spoon is the ideal device for palpation and compression. ■

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