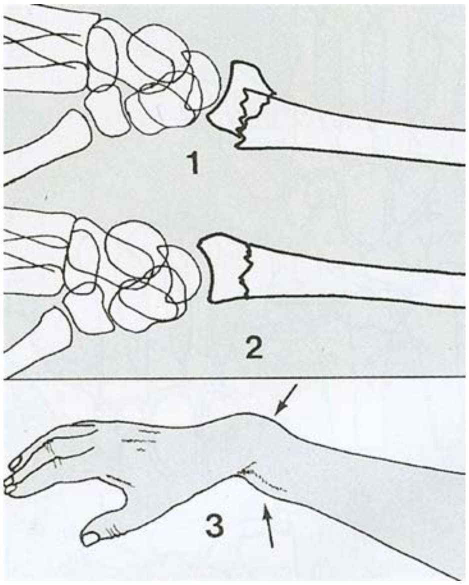

Fig. E-1
Line drawing showing the distal fracture fragment: in 1, the zipper beneath the forearm is opened and the fragment is manually displaced in a dorsal and radial direction; in 2, the fragment can be displaced from the original position; and in 3, the model displays the characteristic dinner-fork deformity. (Reproduced, with permission of Elsevier, from: McRae M, Esser R. Practical fracture treatment. 4th ed. Philadelphia: Elsevier; 2002. p 191-2. Copyright Elsevier [2002].)

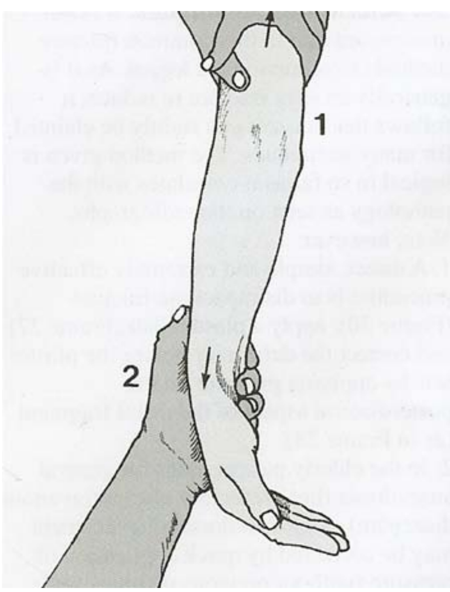

Fig. E-2
Line drawing showing the assistant holding the proximal forearm with both hands (labeled as 1 in the figure) and the participant applying longitudinal traction to the distal fracture fragment (labeled as 2 in the figure). (Reproduced, with permission of Elsevier, from: McRae M, Esser R. Practical fracture treatment. 4th ed. Philadelphia: Elsevier; 2002. p 191-2. Copyright Elsevier [2002].)

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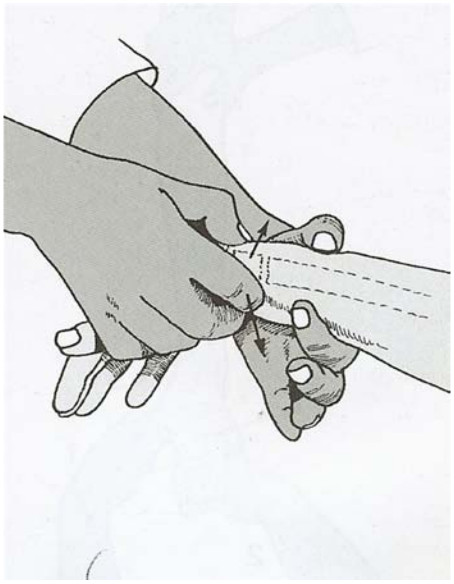

Fig. E-3
Line drawing showing the participant palpating the fracture fragment. (Reproduced, with permission of Elsevier, from: McRae M, Esser R. Practical fracture treatment. 4th ed. Philadelphia: Elsevier; 2002. p 191-2. Copyright Elsevier [2002].)

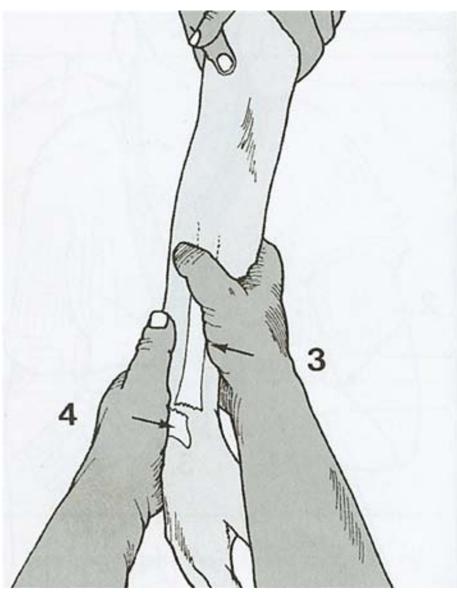

Fig. E-4
Line drawing showing the participant putting downward pressure on the fragment (labeled as 3 and 4 in the figure) while the assistant helps to maintain the traction. (Reproduced, with permission of Elsevier, from: McRae M, Esser R. Practical fracture treatment. 4th ed. Philadelphia: Elsevier; 2002. p 191-2. Copyright Elsevier [2002].)

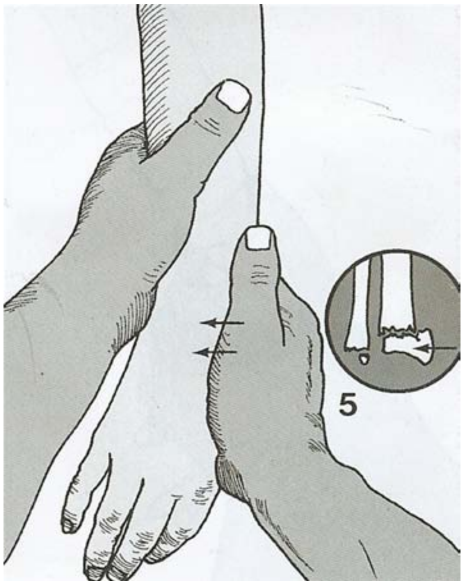

Fig. E-5
Line drawing showing the hand deviated in an ulnar direction to fully reduce the radial deviation (labeled as 5 in the figure). (Reproduced, with permission of Elsevier, from: McRae M, Esser R. Practical fracture treatment. 4th ed. Philadelphia: Elsevier; 2002. p 191-2. Copyright Elsevier [2002].)

TABLE E-1 Design Brief for a High-Fidelity Model of a Distal Radial Fracture

Requirements of the Model
1. The model should closely resemble a human forearm.
2. The distal fragment should be capable of displacement in the dorsal direction and radial direction.
3. The following landmarks should be palpable: radial styloid and ulnar styloid.
4. It should be possible to manipulate the fracture in such a way as to reduce the radial deviation and the dorsal displacement of the distal fragment.
5. It should be possible to adjust the tension in the model to allow two different levels of difficulty of reduction to be simulated.
6. It should be possible to remove the outer covering to review how well the fracture has been reduced.
7. The model should be portable.
8. The model should be durable or contain reusable parts.

http://dx.doi.org/10.2106/JBJS.J.01791

TABLE E-2 Results of the Comparisons of Different Levels of Experience and the Perception of the Physical Qualities of the Model and the Statistical Tests Performed

Comparisons of Physical Qualities Tested	Statistical Tests			
	Point Probability	Chi-Square Test	Pearson Correlation Coefficient	Likelihood Ratio
Registrar compared with specialist registrar				
Looks like a human arm	0.0048	One degree of freedom	8.571 (p = 0.0034)	8.684 (p = 0.0032)
Feels like a human arm	0.0003*	Four degrees of freedom	10.124 (p = 0.0383)	10.397 (p = 0.0342)
Moves like a human arm	0.0491	Three degrees of freedom	1.934 (p = 0.5861)	1.871 (p = 0.5996)
Looks like a fracture	0.0291	One degree of freedom	4.821 (p = 0.0281)	4.78 (p = 0.0287)
Feels like a fracture	0.3073	One degree of freedom	0.011 (p = 0.9171)	0.011 (p = 0.9170)
Moves like a fracture	0.0126	Three degrees of freedom	6.89 (p = 0.0754)	6.28 (p = 0.0987)
Feels similar to reducing a fracture in real life	0.0281	Three degrees of freedom	3.239 (p = 0.3562)	2.972 (p = 0.3959)
Feels like reducing a fracture in real life	0.1135	Two degrees of freedom	0.235 (p = 0.8893)	0.231 (p = 0.8908)
Would be useful as a training tool	0.0115	Two degrees of freedom	4.519 (p = 0.1043)	4.546 (p = 0.1030)
Registrar compared with consultant				
Looks like a human arm	0.0352	Three degrees of freedom	5.658 (p = 0.1294)	4.729 (p = 0.1927)
Feels like a human arm	0.0013*	Four degrees of freedom	12.44 (p = 0.0143)	11.067 (p = 0.0258)
Moves like a human arm	0.0437	Three degrees of freedom	5.231 (p = 0.1556)	4.75 (p = 0.1910)
Looks like a fracture	0.3075	One degree of freedom	0.077 (p = 0.7818)	0.076 (p = 0.7822)
Feels like a fracture	0.2315	One degree of freedom	0.964 (p = 0.3261)	0.927 (p = 0.3357)
Moves like a fracture	0.1782	Two degrees of freedom	0 (p = 0.100)	0 (p = 0.100)
Feels similar to reducing a fracture in real life	0.0878	Three degrees of freedom	2.281 (p = 0.5161)	2.907 (p = 0.4061)
Feels like reducing a fracture in real life	0.1736	Two degrees of freedom	2.006 (p = 0.3667)	1.963 (p = 0.3747)
Would be useful as a training tool	0.1115	Two degrees of freedom	0.75 (p = 0.6872)	0.756 (p = 0.6852)
Consultant compared with specialist registrar				
Looks like a human arm	0.0025	Three degrees of freedom	12.709 (p = 0.0053)	10.489 (p = 0.0148)
Feels like a human arm	0.0223	Four degrees of freedom	4.792 (p = 0.3092)	3.861 (p = 0.4251)
Moves like a human arm	0.0816	Three degrees of freedom	1.787 (p = 0.6178)	2.04 (p = 0.5642)
Looks like a fracture	0.0441	One degree of freedom	4.788 (p = 0.0286)	4.265 (p = 0.0389)
Feels like a fracture	0.2138	One degree of freedom	0.963 (p = 0.3265)	0.9 (p = 0.3427)
Moves like a fracture	0.0526	Three degrees of freedom	4.93 (p = 0.1769)	3.937 (p = 0.2683)
Feels similar to reducing a fracture in real life	0.1838	Two degrees of freedom	1.324 (p = 0.5158)	1.306 (p = 0.5205)
Feels like reducing a fracture in real life	0.2279	Two degrees of freedom	1.337 (p = 0.5125)	1.322 (p = 0.5163)
Would be useful as a training tool	0.1137	Two degrees of freedom	0.667 (p = 0.7165)	0.648 (p = 0.7231)

*Reached a level of significance with a Bonferroni correction to 0.0017.

http://dx.doi.org/10.2106/JBJS.J.01791

Appendix 1

Instructions for Use of the Distal Radial Fracture Model

1. Familiarize yourself with the surface anatomy of the distal radius and hand. Important landmarks to note are the radial styloid and the ulnar styloid. Note that the radial styloid usually sits about 1 cm distal to the ulnar styloid. This relationship will be disturbed when the fracture fragment is displaced.

2. The distal fracture fragment can be displaced from the initial position (labeled as 2 in Fig. E-1) by opening the zipper beneath the forearm and manually displacing the distal fracture fragment in a dorsal (labeled as 1 in Fig. E-1) and radial direction. The zipper is then closed again. The model then displays the characteristic dinner-fork deformity (labeled as 3 in Fig. E-1).

3. To stabilize the proximal forearm, your assistant should hold it firmly with two hands (labeled as 1 in Fig. E-2).

4. Hold the forearm with both hands, one hand on the radial side and one hand on the ulnar side. Both thumbs should be on the dorsal surface of the forearm.

5. Gradually feel your way down the arm with your thumbs until you feel the fracture fragment (Fig. E-3).

6. Hook your thumbs behind the fracture fragment and pull the fragment toward you; start gently at first and gradually build up the force (Figs. E-2 and E-3).

7. When you feel the fragment move toward you, you can then begin to put downward pressure on the fragment with your thumb (labeled as 3 in Fig. E-4) and stabilize the arm with your other hand (labeled as 4 in Fig. E-4) while your assistant maintains the traction.

8. Finally, deviate the hand in an ulnar direction (labeled as 5 in Fig. E-5) to fully reduce the radial deviation.

9. Check the alignment by comparing the relative height of the radial and ulnar styloids with the previous height.

Appendix 2

Questionnaire on the Perception of the Model

Section 1: General Questions

1. What is your current level of employment? (Check the appropriate box.)
Intern □
House Officer □
Registrar □
Specialist Registrar □
Consultant □

2. How much experience in orthopaedics do you have?
___________years ___________months

3. How many times have you performed the procedure of manipulation of an extra-articular fracture of the distal radius? (Give your best estimate.)
During your orthopaedic career: ___

4. Have you ever used a model for learning an orthopaedic skill?
Yes No

5. Did you find that model useful to help to learn an orthopaedic skill?
Yes No

Section 2: Model Questions

On the basis of your first impression of the model, please indicate whether or not you agree with the following statements. (Circle the most appropriate answer: 1, disagree; 2, mostly disagree; 3, neutral; 4, mostly agree; or 5, agree.)

1. The model looks like a human forearm.
1 2 3 4 5

2. The model feels like a human forearm.
1 2 3 4 5

3. The model moves like a human forearm.
1 2 3 4 5

Please answer the following questions after you have had the opportunity to see the fracture displaced and you have manipulated it back into position.

4. The model looks like it has a fracture deformity.
1 2 3 4 5

5. The model feels like there is a fracture deformity.
1 2 3 4 5

6. The model allows me to reduce the fracture with a method similar to that which I would use in real life.
1 2 3 4 5

7. When I reduce the fracture on the model, it feels similar to real life.
1 2 3 4 5

8. When I reduce the fracture on the model, it feels like a close approximation to real life.
1 2 3 4 5

http://dx.doi.org/10.2106/JBJS.J.01791

9. Do you think that the model could be used to teach someone new to orthopaedics the basic steps of this procedure?

1 2 3 4 5

Comments