RadioGraphics

Gallery of Medical Devices

Part 1: Orthopedic Devices for the Extremities and Pelvis[1]

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This gallery of orthopedic devices is designed as a quick reference for readers who wish to identify an unfamiliar device in the extremities or pelvis (1), specifically a device used for fracture fixation or in joint arthroplasty. The basic goal of fracture fixation is to stabilize the fractured bone, to enable fast healing of the injured bone, and to achieve early mobility and full function of the injured extremity. The basic principles of fracture fixation and the complications associated with them were discussed in previous *RadioGraphics* articles, as well as other references (2–8). Herein, we illustrate many of the fracture fixation devices found in everyday practice (Figs 1–27). In addition, in a previous article, we illustrated the most commonly used joint prostheses and addressed important points for the correct recognition and radiologic evaluation of these devices (9). Proper placement of these devices and complications associated with them were also discussed (3–10). Herein, we present an overview of many common joint prostheses (Figs 28–43).

In summary, we provide a comprehensive overview of important orthopedic devices frequently found in the extremities and pelvis. It is intended to allow the reader to identify a device generically and to understand its purpose. It is important to understand the purpose of and proper function for a medical device, but it is not important—and is probably impossible—to describe every device by its proper brand name. For a detailed discussion of a particular device, the reader should refer to the appropriate references cited. A gallery of spinal devices and devices found in the head, neck, chest, abdomen, and pelvis will appear in a subsequent article (11).

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See Taljanovic et al in the July 2005 issue for Part 2 of this two-part series of articles.

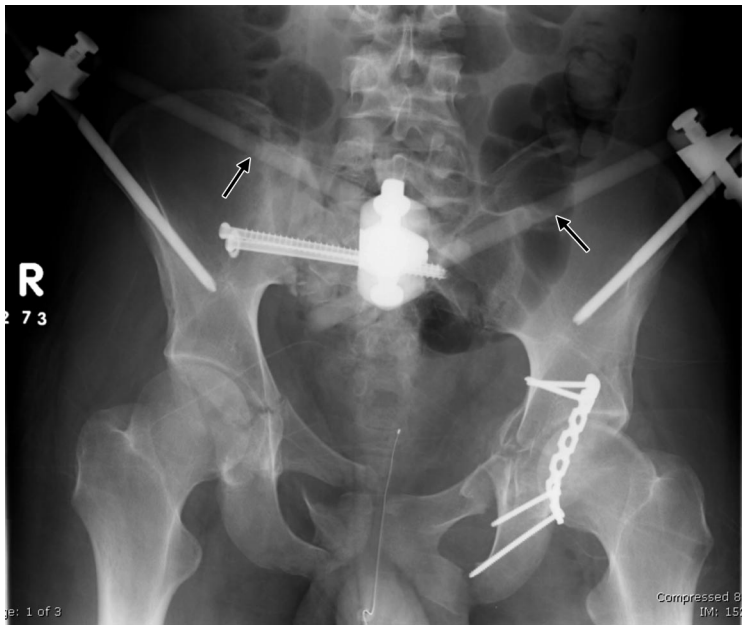

Figure 1. Uniplanar external fixator. Anteroposterior radiograph of the pelvis in a patient with multiple bilateral pelvic fractures causing pelvic ring disruption shows a standard uniplanar fixator (Hoffman external fixator; Howmedica, Rutherford, NJ) with Schantz pins that transfix both iliac bones with carbon-fiber interconnecting rods (arrows). Two cancellous cannulated screws (proximal fully threaded and distal partially threaded with a washer) transfix the right sacral fracture and sacroiliac joint. A pelvic reconstruction plate with four 3.5-mm (screw diameter) fully threaded cortical screws transfixes the posterior wall of the left acetabulum.

Figure 2. Mini uniplanar external fixator. Anteroposterior radiograph of the hand in a patient with multiple hand fractures and partial amputations of the fingers shows an H-shaped mini uniplanar fixator (Synthes, Paoli, Pa). The fixator transfixes the first metacarpal corticotomy site for a lengthening procedure.

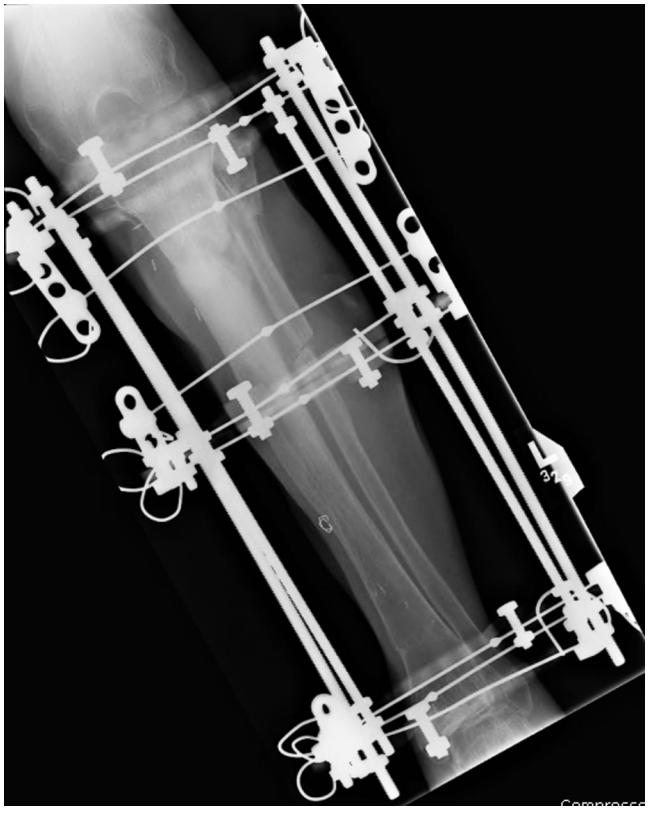

Figure 3. Ring external fixator. Anteroposterior radiograph of the leg shows a ring external fixator (Ilizarov; Smith & Nephew, Memphis, Tenn) that transfixes a proximal tibial diaphyseal fracture nonunion. Posttraumatic deformities of the proximal tibial diametaphysis and proximal fibula, as well as a midfibular diaphyseal osteotomy, are also seen. The Ilizarov device was initially used for bone transport and limb-lengthening procedure.

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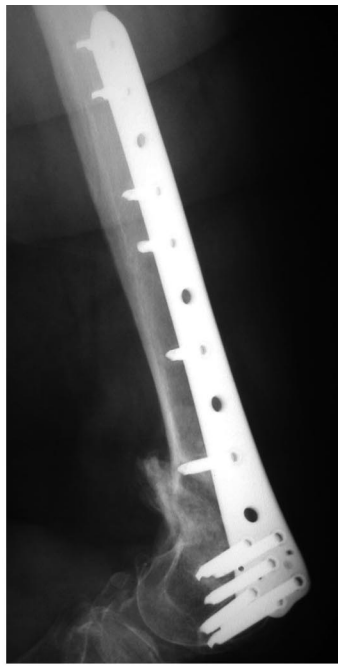

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9a.

9b.

Figures 4–9. Fixation plates. **(4)** Anteroposterior radiograph of the ankle shows a one-third tubular plate with four 3.5-mm proximal cortical screws and two 4.0-mm distal cancellous screws (Synthes) that transfix a lateral malleolus fracture. The third distal screw through the plate is interfragmentary (2). **(5)** Anteroposterior radiograph of the distal femur shows a 95°-angle blade plate with multiple cortical screws that transfix a healing diaphyseal fracture nonunion site. Note an intramedullary nail track related to prior surgical hardware. Bone graft is seen at the fracture site (arrow). Skin staples overly the soft tissues. **(6)** Anteroposterior radiograph of the ankle in a patient with a bimalleolar fracture shows a 3.5-mm locking low-contact dynamic compression plate and four proximal cortical screws that transfix the lateral malleolus fracture, with two fully threaded syndesmotic screws and two distal fully threaded locking screws placed through the plate. Locking screws contain a threaded screw head that engages threads in the screw hole (2). A plaster splint is present. **(7)** Lateral radiograph of the distal femur shows a less invasive stabilization system (LISS) plate (Synthes) with multiple fixed-angle screws that transfix the distal femoral diametaphyseal fracture (2). **(8)** Lateral radiograph of the distal leg shows a periarticular locking plate (Synthes) with multiple screws that transfix the distal tibial diametaphyseal fracture site. The plate is pre-contoured for use in a periarticular location. A plaster splint is also present. **(9)** Anteroposterior **(a)** and lateral **(b)** radiographs of the distal forearm show a 3.5-mm locking dynamic compression plate (Synthes) with multiple screws that transfix a healed distal radial diaphyseal fracture. A volar periarticular fixed-angle plate (Avanta Orthopaedics, San Diego, Calif) with a proximal screw transfixes a newer, healing distal radial diametaphyseal fracture site.

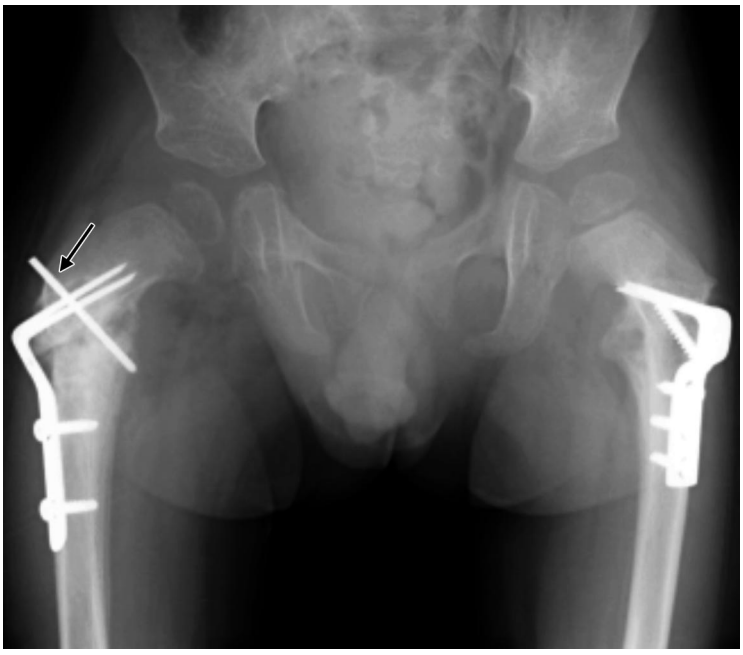

Figure 10. Blade plates. Frontal radiograph of the pelvis shows bilateral proximal femoral varus osteotomy. A pediatric fork blade plate with multiple screws (Synthes) and a fully threaded Steinman pin (arrow) transfix the right femoral osteotomy site. Another 90° osteotomy pediatric blade plate (Synthes) transfixes the left femoral osteotomy site.

Figure 11. Spider plate. Frontal radiograph of the wrist shows a spider plate (KMI, San Diego, Calif) used for partial carpal (four-corner) fusion. Note the scaphoid bone resection.

Figure 12. Anatomically shaped plate. Frontal radiograph of the knee shows a specially designed short plate (PUDDU; Arthrex, Naples, Fla) with two proximal fully threaded cancellous and two distal cortical screws with an intervening spacer (medial wedge) that transfix a proximal tibial metaphyseal osteotomy site. Synthetic bone graft material is placed at the osteotomy site. An external cooling device (external liner) overlies the skin. A hinged knee brace and skin staples are also seen.

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14a.

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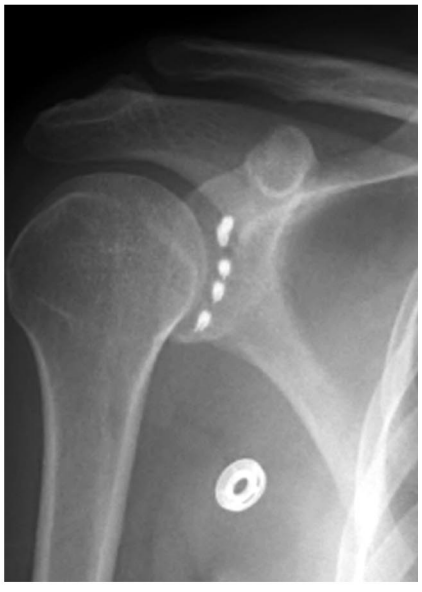
15a.

15b.



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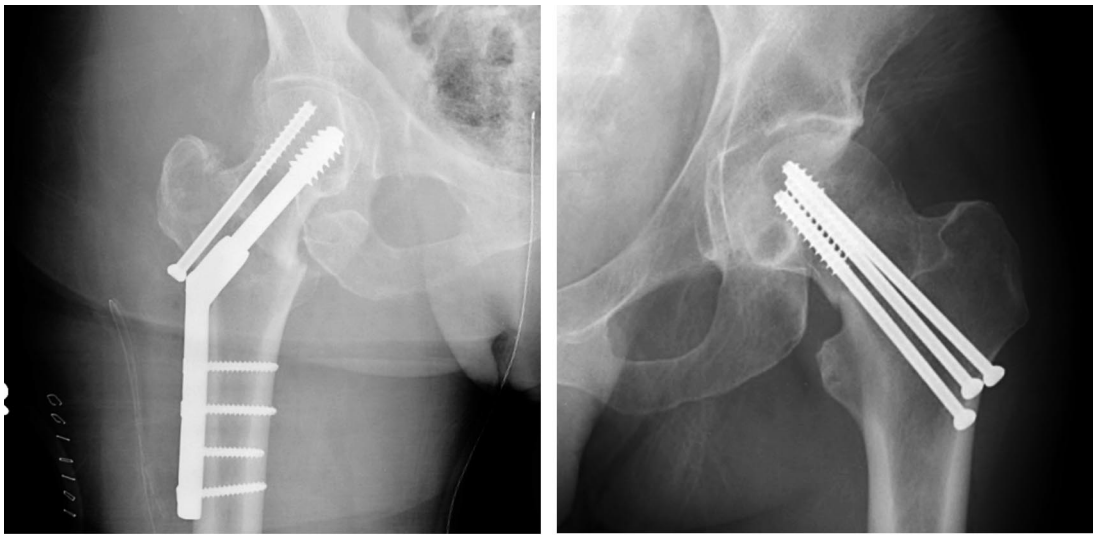
Figures 13–16. **(13)** Low-contact dynamic compression plate. Oblique **(a)** and lateral **(b)** radiographs of the wrist show a low-contact dynamic compression plate (Synthes) used for arthrodesis. Note tapering of the distal plate to accommodate osseous anatomy. **(14)** Oblique T plate. Anteroposterior **(a)** and lateral **(b)** radiographs of the wrist show an oblique 3.5-mm (screw diameter) T plate with multiple screws that transfix the distal radial fracture. **(15)** Interference screws and surgical staples. Oblique **(a)** and lateral **(b)** radiographs of the knee in a patient who had undergone anterior cruciate ligament reconstruction demonstrate a metallic interference screw in the lateral femoral condyle, a bioabsorbable (radiolucent) screw tunnel, and two staples in the medial tibial plateau. Surgical staples are seen in the medial femoral condyle, consistent with medial collateral ligament repair. **(16)** Suture anchors (Mitec screws; Mitec, Westwood, Mass). Anteroposterior radiograph of the shoulder in a patient who underwent Bankart lesion repair (anterior capsular repair) shows multiple anchor screws overlying the anterior glenoid.



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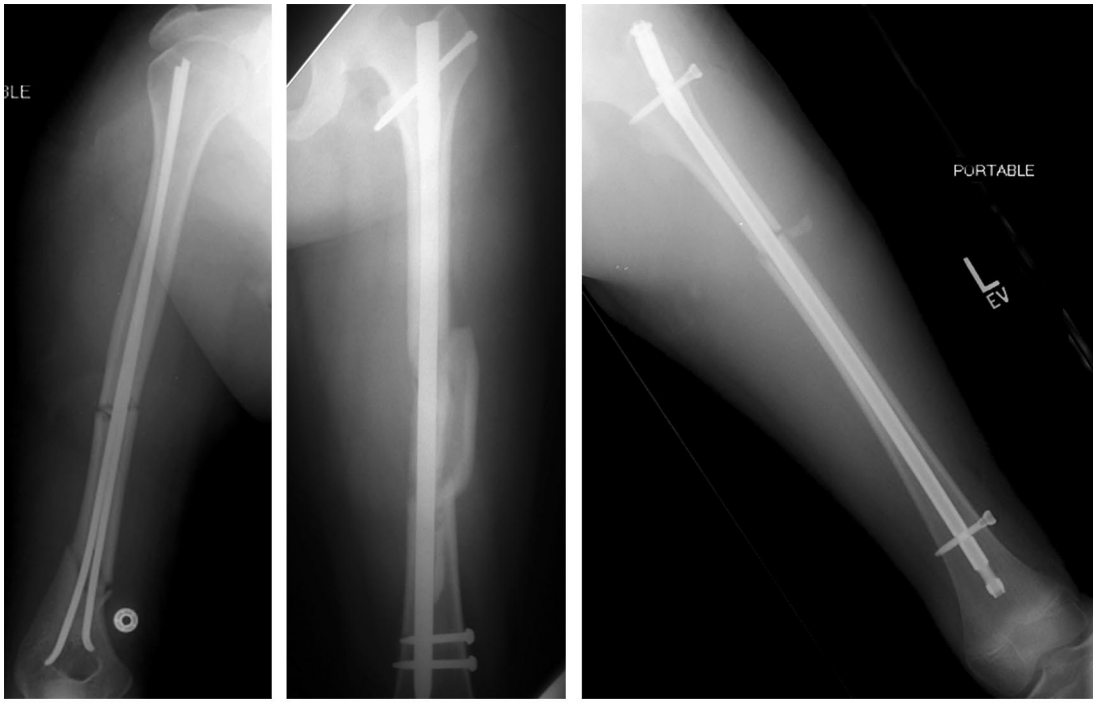
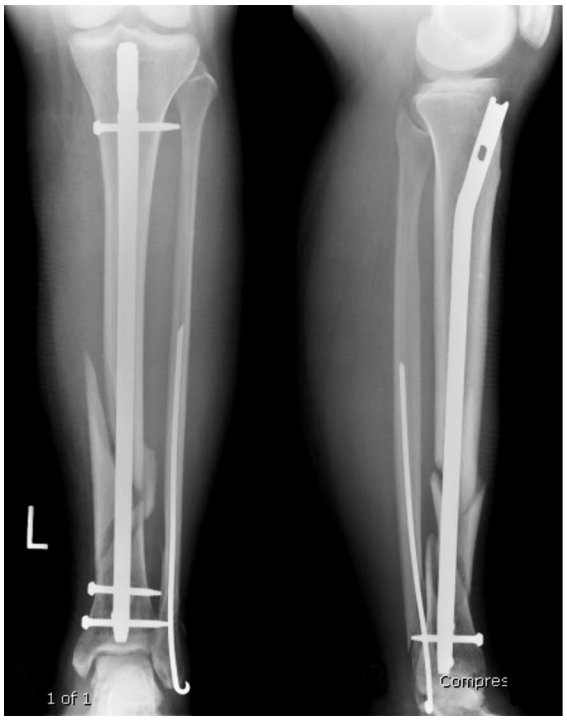
Figures 17, 18. **(17)** Dynamic compression hip screw. Anteroposterior radiograph of the hip shows a dynamic compression hip screw device (Synthes) and a partially threaded cannulated cancellous screw that transfixes the intertrochanteric fracture. Note the surgical drain and staples overlying the lateral soft tissues and a Foley catheter. **(18)** Cannulated cancellous screws. Anteroposterior radiograph of the hip shows three 7.3-mm cancellous partially threaded cannulated screws that transfix a subcapital femoral neck fracture.



19. 20. 21.

Figures 19–21. Intramedullary nails. **(19)** Anteroposterior radiograph of the upper arm shows two flexible titanium intramedullary nails (Synthes) that transfix a mid-distal humeral diaphyseal fracture. The nails are placed antegrade. Note the cut edges of the proximal ends of both rods and the prebent, intact distal ends. **(20)** Anteroposterior radiograph of the femur shows an antegrade intramedullary nail (Zimmer, Warsaw, Ind) with one proximal oblique and two distal interlocking screws that transfix a comminuted mid-diaphyseal femoral fracture. **(21)** Anteroposterior radiograph of the femur shows a trochanteric intramedullary nail (TAN nail; Smith & Nephew) with one proximal screw and one distal interlocking screw that transfix a comminuted proximal femoral diaphyseal fracture. The nail had a greater trochanter entry point.



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Figures 22, 23. **(22)** Intramedullary nail and Rush rod. Anteroposterior (left) and lateral (right) radiographs of the leg show an antegrade intramedullary nail (Synthes) with one proximal and three distal interlocking screws that transfix a spiral distal tibial diaphyseal fracture and a Rush rod (Zimmer) that transfixes a distal fibular diaphyseal fracture. **(23)** Trochanteric fixation nail and helical blade. Anteroposterior radiograph of the hip in a patient with an intertrochanteric fracture shows a short trochanteric femoral fixation intramedullary nail with a helical (spiral) blade (TFN; Synthes) placed through the proximal nail that transfixes the femoral neck and head.

Figure 24. Intramedullary nail and wound-vac. Anteroposterior radiograph of the leg shows an antegrade intramedullary nail (Zimmer) with one proximal and two distal interlocking screws that transfix a distal tibial diaphyseal fracture site. A wound-vac drain (arrow) is placed at the fracture site. Note a displaced fracture of the distal fibular shaft and surgical staples about the proximal leg, knee, and ankle.

Figure 25. Small reconstruction plate. Anteroposterior radiograph of the hand shows a reconstruction plate with four screws and a Kirschner wire that transfix the first metacarpal osteotomy site. Iliac crest bone graft is placed at the osteotomy site (arrow).

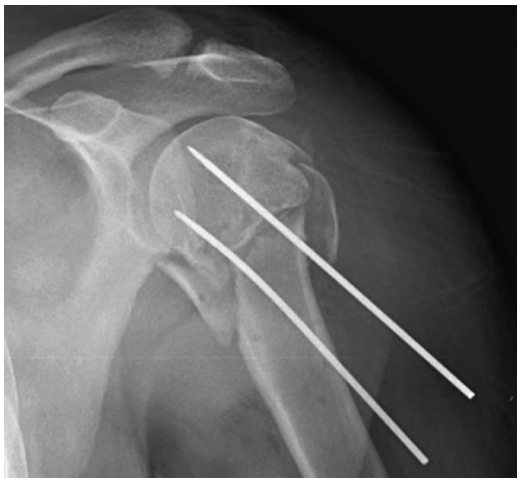
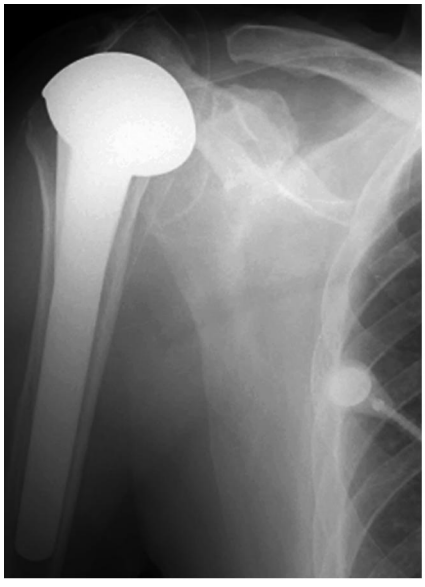


Figure 26. Steinman pins. Anteroposterior radiograph of the shoulder shows two Steinman pins (Synthes) that transfix a comminuted proximal humerus fracture.

Figure 27. Herbert screws. Oblique radiograph of the fingers in a patient with rheumatoid arthritis shows three Herbert screws (Zimmer) that transfix the proximal interphalangeal joints of the second, third, and fourth fingers, used for fusion.

Figures 28, 29. Shoulder arthroplasty. **(28)** Anteroposterior radiograph of the shoulder shows a shoulder hemiarthroplasty–proximal humerus prosthesis (Rotator cuff arthroplasty; DePuy, Warsaw, Ind). **(29)** Anteroposterior radiograph of the shoulder shows a total shoulder arthroplasty with a cemented metal baked keeled glenoid component and a cementless humeral component (Biomodular; Biomet, Warsaw, Ind).



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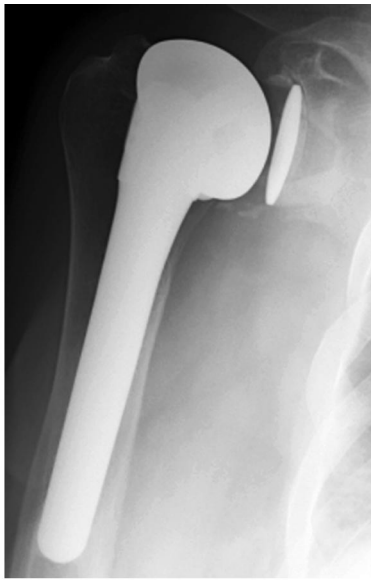

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Figure 30. Radial head prosthesis and tension band. Lateral view of the elbow shows a radial head prosthesis (Evolve; Wright Medical, Arlington, Tenn) and a tension band (combination of two Kirschner wires and trauma wires) that transfix an olecranon fracture. The patient underwent arthroplasty for a severely comminuted radial head fracture.

Figure 31. Radiocarpal and metacarpophalangeal joint arthroplasty. Anteroposterior radiograph of the hand in a patient with rheumatoid arthritis shows prostheses in the radiocarpal joint and second through fifth metacarpophalangeal joints (Swanson-silicone implants with titanium grommets; Wright Medical). Silicone prostheses are commonly used in the metacarpophalangeal and interphalangeal joints and are no longer used in the wrist.

Figure 33. Proximal interphalangeal joint arthroplasty. Lateral radiograph of a finger in a patient with psoriatic arthritis shows a proximal interphalangeal joint arthroplasty (Avanta Orthopaedics) and a mini Acutrak screw (Acutrak screw system; Acumed, Hillsboro, Ore) used for distal interphalangeal joint fusion.

Figure 32. Trapezium prosthesis. Anteroposterior radiograph of the wrist in a patient with osteoarthritis shows a silicone trapezium prosthesis (Swanson; Wright Medical).

Figures 34–38. Hip arthroplasty. **(34)** Anteroposterior radiograph of the hip shows a unipolar hip hemiarthroplasty (endoprosthesis) with a cemented femoral component (Summit; DePuy). **(35)** Anteroposterior radiograph of the hip shows bipolar hip arthroplasty (Zimmer) and an 11-hole 4.5-mm (screw diameter) cable plate (cables passed through the plate) (Biomet) that transfixes the proximal femoral diaphyseal periprosthetic fracture. The distal two wires are cerclage wires. Note the skin staples and a drain overlying the lateral soft tissues. **(36)** Anteroposterior radiograph of the hip shows a total hip arthroplasty (Pinnacle cup and Summit porous-coated stem; DePuy). Note the two cerclage wires about the proximal femoral shaft that were used because a longitudinal fracture through the proximal femur (not visible here) occurred during the femoral stem placement. **(37)** Anteroposterior radiograph of the hip and proximal femur shows a revision total hip prosthesis that was placed because of periprosthetic femoral fracture and loosening. Note a splined tapered straight femoral stem component and two cable wires proximally and two cerclage wires distally (Ranawat/Bernstein acetabular component, Biomet; Mallory-Head calcar replacing femoral stem, Biomet). **(38)** Anteroposterior radiograph of the hip in a patient with a history of a hip infection and degenerative joint disease shows a cemented femoral stem (Answer; Biomet) and a cemented all-polyethylene acetabular component used as an articulating antibiotic spacer (Biomet) as a part I stage reimplantation arthroplasty (10).

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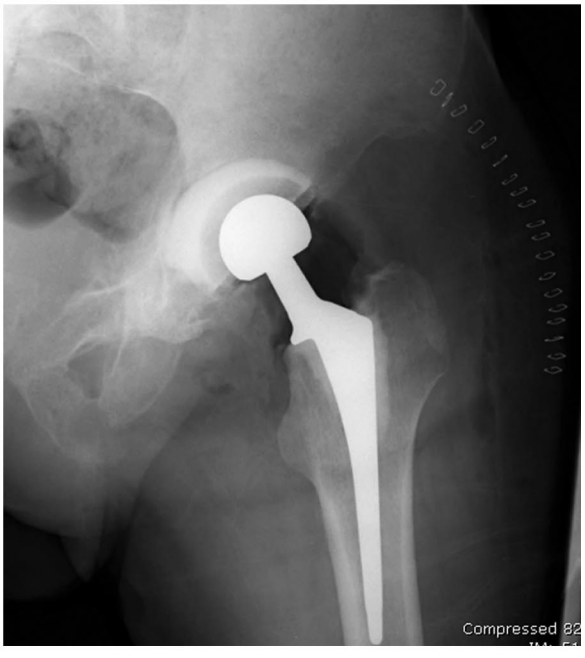

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Figures 39–41. Knee arthroplasty. **(39)** Anteroposterior **(a)** and lateral **(b)** radiographs of the knee demonstrate a unicompartmental knee prosthesis placed in the medial compartment (Johnson & Johnson; Rayham, Mass). **(40)** Anteroposterior **(a)** and lateral **(b)** radiographs of the knee show a cruciate-substituting total knee prosthesis (note large distal femoral box in **b**) and resurfacing of the patella (Genesis II; Smith & Nephew). Note the postoperative drain that overlies the suprapatellar pouch (9). **(41)** Anteroposterior **(a)** and lateral **(b)** radiographs of the knee show a cruciate-retaining total knee prosthesis with cementless femoral and cemented tibial components and resurfacing of the patella (Natural knee system; Zimmer). Note the postoperative drain and skin staples (9).

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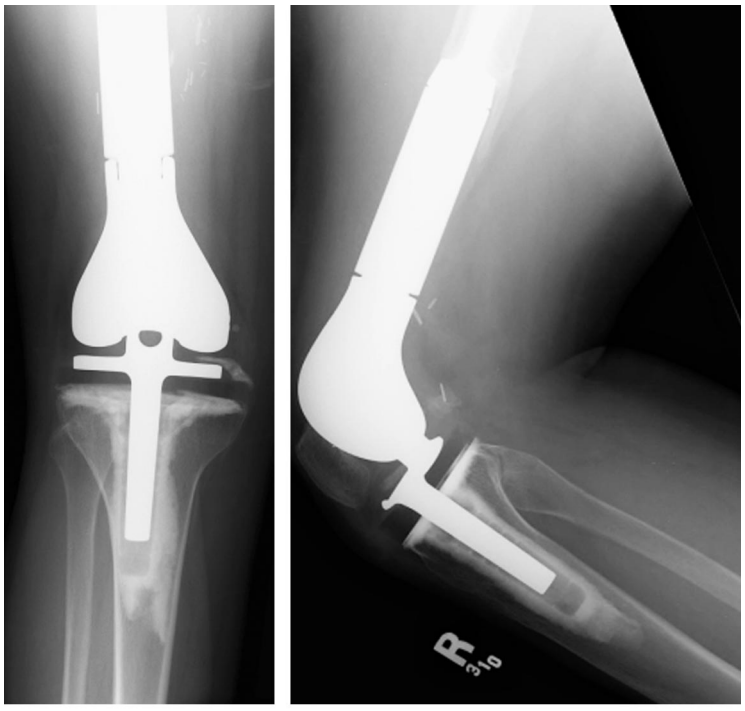

a. **b.**

Figure 42. Limb-salvage total knee arthroplasty. Anteroposterior **(a)** and lateral **(b)** radiographs of the knee in a patient who underwent distal femoral resection because of Ewing sarcoma show a custom modular total knee prosthesis (Howmedica) designed for limb salvage.

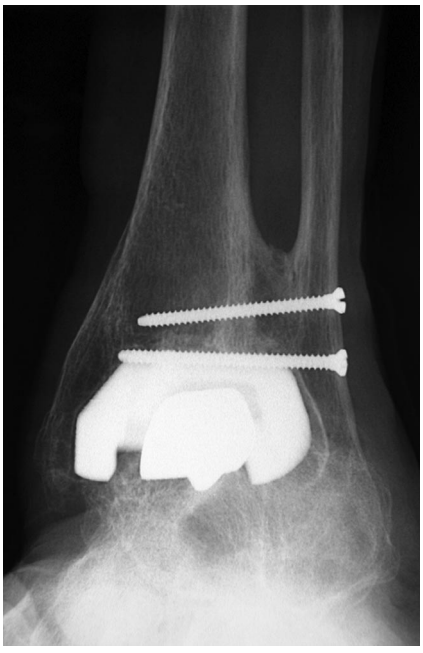

Figure 43. Total ankle arthroplasty. Anteroposterior radiograph of the ankle shows a fixed-bearing porous-coated total ankle prosthesis, with a partially conforming articulation (Agility; DePuy). Note the fused tibiofibular syndesmosis (9).

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