distal to styloid process of radius and ulna through the capitate
carpal bone. Smith et al. (1996) indicate that the axis migrates di-
tally when moving from full flexion to extension, which is caused
by translatory and rotational movements of the lunate and
scaphoid. These movements change the height of the bones of the
wrist, which is necessary to maintain tension on the ligaments.
Muscles that lie anterior to the wrist’s flexion/extension axis are
wrist flexors, whereas muscles lying posterior to the axis are wrist
extensors.

There is a different amount of movement at the different joints
of the wrist as the distal carpi glide on the proximal carpal row to
produce flexion and extension. In flexion, the greatest degree of
movement occurs at the radiocarpal joint, a significant amount of
movement at the intercarpal joint, and less movement at the mid-
carpal joints. In extension, the movement of the midcarpal joints
is the most significant, and secondary movement is achieved at the
radiocarpal joint (Figure 7-3A, B).

Flexion of the wrist is produced when the carpals slide dorsally
on the radius and the disk. It has been estimated that 60% of the
flexion motion occurs at the midcarpal and 40% at the radiocarpal
joint. The movement of flexion is often accompanied by slight
ulnar deviation and supination, and the primary wrist flexors are
flexor carpi radialis, flexor carpi ulnaris, and palmaris longus. End
feel for wrist flexion is firm secondary to tautness of the dorsal
radiocarpal ligament and dorsal joint capsule.

Wrist extension also has a firm end feel secondary to the taut-
ness of the palmar radiocarpal ligament and palmar joint capsule.
The motion of extension is initiated by the distal carpals, with the
capitate at center as the axis. It has been estimated that 67% of the
movement of extension occurs at this radiocarpal joint. Ligaments
draw the capitulum and scaphoid together in a close packed posi-
tion, which increases the extensor force and unites the carpals,
which now will act as a single unit. Midcarpal motion, estimated at
33% at this midcarpal joint, occurs with distal carpals gliding on
proximal carpals (lunate and triquetrum), which are relatively
fixed. Full wrist extension requires a slight spreading of distal radius
and ulna, and if these two bones were grasped together, complete
wrist extension would not be possible (Smith et al., 1996). Wrist
extension is usually accompanied by slight radial deviation and
pure extension (without deviation) is dependent upon the ulnar
and radial extensors working together for balance. The most pow-
ful extensors are the extensor carpi radialis longus, extensor carpi
radialis brevis, and extensor carpi ulnaris. These muscles are active
in activities requiring wrist extension or stabilization against resis-
tance, especially if pronated, as occurs when doing the backhand
stroke in racquet sports (Hamil & Knutzen, 1995).

Ulnar and Radial Deviation

Ulnar and radial deviation (Figure 7-4) are terms that are syn-
onyymous with ulnar flexors and extensors and wrist adduction and
abduction. This motion occurs in the frontal/coronal plane at the
anterioposterior/sagittal axis, with the axis of motion through the
capitate at a right angle to the palm (Nicholas & Hershman,
1990). Motion that occurs lateral to this front-to-back axis is rad-
ial deviation (abduction) and motion medial to this axis is ulnar
deviation (adduction). There is more movement in ulnar deviation
than radial because the radial styloid process comes into contact
with the scaphoid in radial deviation, which prevents further
motion and causes the normal hard end feel. Ulnar and radial devi-
ation is greatest if the wrist is neutral regarding wrist flexion or
extension. If the wrist extends, very little deviation occurs because
the carpals are drawn into a locked, close packed position. In wrist
flexion, further movement is not possible because the bones are
already splayed and the joint is in its loose packed position (Norkin
& Levangie, 1996).

In radial deviation, the proximal carpal row moves ulnarly on
the radius and the radioulnar disk, while the distal row of carpal
bones is displaced radially. If movement occurred in a single plane
(frontal), the distal row would swing radially during radial devia-