Fig. 4.4 Fascia of the trapezius as extension of the tentorium.
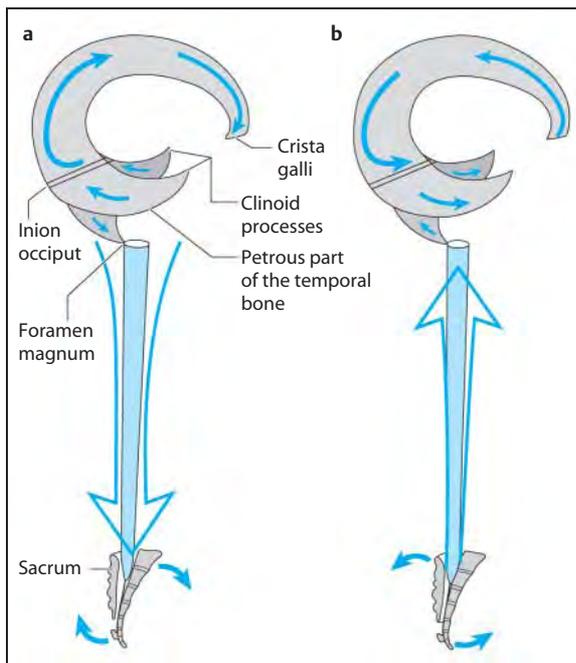

Fig. 4.5a, b "Reciprocal tension membranes" with attachments.

The subarachnoidal space is connected to the ventricles in which the liquor is produced (choroid plexus). Some 95% of the reabsorption of the liquor takes place in the arachnoid villi of the venous sinus. The remaining 5% is reabsorbed via the lymphatic system.

The dural system is a very resistant membrane that attaches at certain places and forms a hose-like structure filled with CSF and nerves. This means that pressure or tension at one place spreads to the entire system. We can compare this to an air-filled balloon that is compromised in one spot. This pressure can be felt everywhere on the balloon. The entire dural system has five points of attachment whose common anchor is the Sutherland fulcrum:

- In front, the crista galli and clinoid processes
- Laterally, the two temporal bones
- In back, the occipital bone
- Below, the sacrum

The fact that pulling on one of these points affects all others via the Sutherland fulcrum is of clinical significance. In other words: a sacral malposition affects the occipitoatlantoaxial (OAA) complex just as much as a malposition in the temporal bone or sphenoidal bone. The consequences are even greater in the spinal column because the sensitive muscle spindles there have an exponential effect.

While the cranial sutures do not permit movement per se, as we know it from the extremities of the spinal column, they do allow for malleability. Movements related to craniosacral impulses do not cause a volume change in the cranium, but only a deformation of the entire hydraulic system including the spinal column and pelvis. Since these movements proceed harmoniously, restrictions in one point of the system manifest everywhere.

If the disturbance is significant enough, the whole system adapts in order to function. This leads to adjustments in the structures, which ultimately causes structural or postural changes. This is the meaning of the term "**reciprocal tension membranes**" (**Fig. 4.5**)

Note: Opinions differ on the trigger of craniosacral movements. In general, it is assumed that fluctuations in the liquor cause tensions in the dural system that in turn affect the bones. The special anatomy of the cranial sutures and the attachments of the dura are responsible for specific movement patterns.

4.3 The Movements and Dysfunctions of the Craniosacral Mechanism

For a detailed description, we once again refer the reader to the relevant literature. We will only describe here what is necessary for understanding the following content.

■ Flexion and Extension

When Sutherland defined the two stages of the craniosacral rhythm, he called them flexion and extension because he considered the SBS to be the center of movement. In conforming to the nomenclature, flexion of the SBS corresponds to a reduction in the angle between the basilar part of the occiput and of the sphenoid body. Extension corresponds to an increase in this angle.

Flexion

The occipital bone makes a backward rotation, and the sphenoidal bone makes a forward rotation, in which the SBS rises. Globally, both bones make a forward movement. This is important for the relationship between occiput and atlas. **In cranial flexion, the occipital bone slides forward over the atlas** (**Fig. 4.6a**). This corresponds to a mechanical extension of the occiput. The ethmoidal bone, lying in front of the sphenoidal bone, makes the same rotation as the occipital bone. The paired or peripheral bones make an external rotation during flexion.

The forward movement of the occipital bone and upward movement of the basilar part shift the foramen magnum forward. This results in a cranial pull on the spinal dura mater. Consequently, the base of the sa-
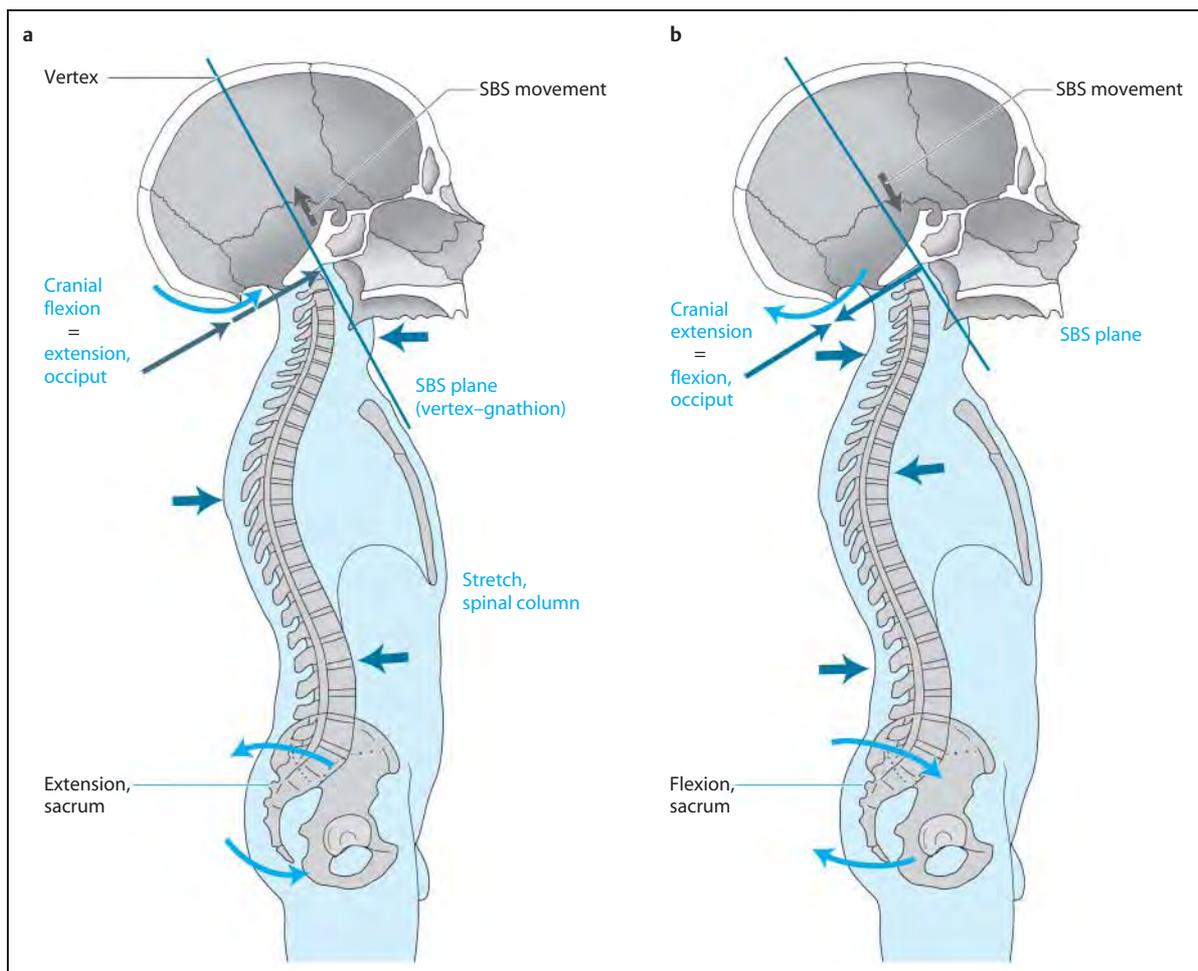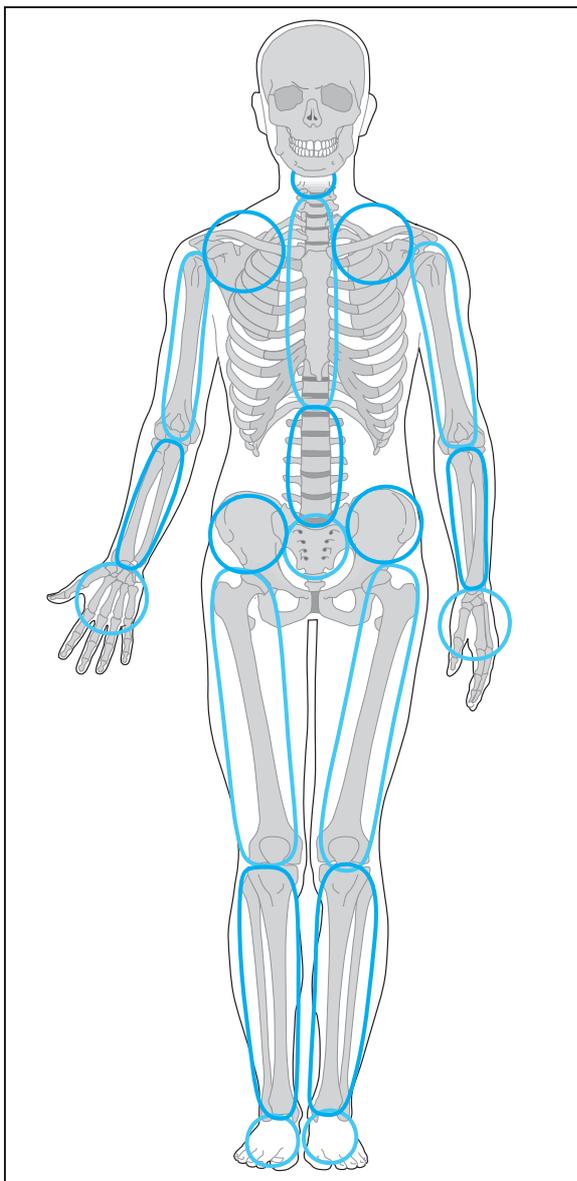

Fig. 4.6a, b   **a** Biomechanics of cranial flexion: movement of the occiput over the atlas. **b** Biomechanics of cranial extension: movement of the occiput over the atlas.

Fig 8.1   Motor units.

Littlejohn's pivots and the joints in the extremities are located more or less exactly on the crossings of lemniscates or in the center of loops. Here we can see that Littlejohn's model is not only structural but also functional.

The arrangement of the muscles in lemniscates facilitates a very energy-efficient execution of smooth movements in all planes. It becomes possible to convert potential energy into kinetic energy. Thereby, the effect of a spiral or spring is obtained (see the gait study in Chapter 3, p. 39). An additional advantage is the fact that pressure on the vessels, thorax, and abdomen is reduced.

Note: The greater the load that we must transport, the greater our muscular exertion becomes because we can no longer utilize the momentum of the movement. At the same time, this increases the strain on the joints, respiration, and circulation. Muscle contractions and joint blockages have the same effect.

8.1   Muscle Chains

In the preceding chapters, we have introduced a number of muscle chain models. While some have certain similarities (Busquet and Chauffour, both from the French school), others are very specialized (Myers, Struyf-Denis). Each of the authors described their model from a particular perspective. For Rolfers, for example, certain aspects dominate more than for osteopaths or physiotherapists.

In addition, we described the mechanical aspect of cranial osteopathy, the Zink patterns, and Littlejohn's model of the spinal column. Furthermore, we determined that one of the main functions of the locomotor system, namely the gait, reproduces the behavior of the spinal column and the pelvis, as described by Sutherland, Zink, and Littlejohn in their models.

For us, it is obvious that it is the muscles that form these patterns. This is by no means in contradiction to Sutherland's craniosacral theory. No matter whether a pattern is triggered by the skull, the trunk, or the extremities, the rest of the body adopts the same pattern (for economical reasons; to avoid burdening the brain). This is important from a craniosacral perspective because it allows the primary respiratory mechanism (PRM) to function free of stress.

This also explains why the segment or the skull is adjusted in the lesion pattern during treatments with the Sutherland techniques. This allows for a flexion and extension of the PRM that is as free as possible.

The muscle chain model that we propose differs from the other models in two essential respects:

1. We are convinced that flexion and extension alternate in the spinal column and upper extremity as they do in the lower extremity. The definition of flexion is the bringing together of both ends of an arch; extension is the distancing of the ends of an arch. The spinal column consists of three arches, of which two are dorsally concave, and one is ventrally concave. Accordingly, flexion of the cervical spinal column (CSC) is a posterior flexion, that of the thoracic spinal column (TSC) is an anterior flexion, and that of the lumbar spinal column (LSC) is again a posterior flexion.

   This perspective on flexion and extension of the spinal column is interesting in that it accords with Sutherland's model. Cranial flexion corresponds to an extension of the spinal column, that is, an extension of the three arches. Cranial extension is the opposite.

   On the upper extremity, we also find an alternation between flexion and extension (upper arm in extension, elbow flexed, fist extended, and fingers flexed, see the position of the arm during writing). We believe that a slight flexion in the elbow and a medium position between pro- and supination constitutes the neutral position of the lower arm.

2. In our opinion, there are only two muscle chains in each half of the body:
   — a flexion chain; and
   — an extension chain.

As described by Sutherland, external rotation and abduction are associated with flexion, and internal rotation and adduction with extension (see **Figs. 8.2** and **8.3**). This results in the following combinations:
- Flexion + abduction + external rotation
- Extension + adduction + internal rotation

Note: We point out again that cranial flexion corresponds to extension in the parietal plane.

The arrangement of muscles in the shape of lemniscates permits a continuity of myofascial chains between individual spinal column segments and thereby creates connections between right and left. The same is true for the extremities.
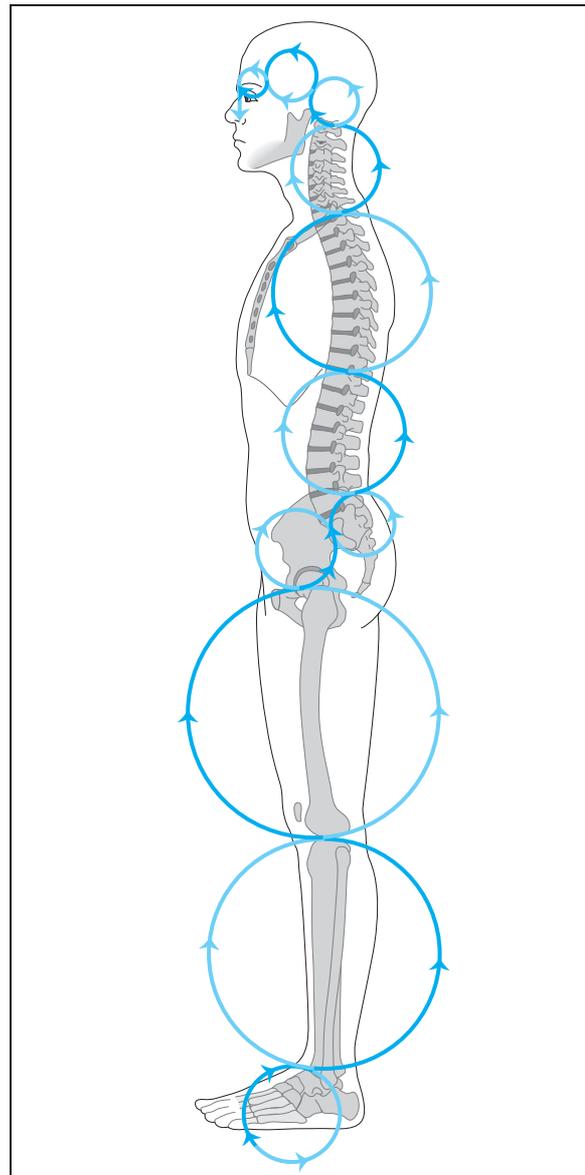

Fig. 8.2 Behavior of individual motor units in case of dominance of a flexion pattern (*bright blue*) or extension pattern (*dark blue*).

The inhibition of the antagonist and the crossed stretch reflex are the neurophysiological foundations for the formation of torsion patterns.

Before describing the muscle chains, we first want to describe the functional motor units of the skeleton:

■ Medial Pterygoid Muscle (Fig. 19.13)

Origin

- Inside the lateral pterygoid plate
- Pterygoid bone
- Maxillary tuberosity
- Pyramidal process of the palatine bone

Insertion

Inside the mandibular joint

Action

Moving the lower jaw forward, upward, and lateral (chewing)

Innervation

Medial pterygoid nerve from the mandibular nerve (trigeminal nerve)

Trigger Point Location

The trigger points of this short muscle are found by intraoral palpation roughly in the middle of the muscle belly (see also **Fig. 19.11**, page 131).

Referred Pain

- Tongue
- Pharynx
- Larynx
- Temporomandibular joint

Associated Internal Organs

None

Fig. 19.13

■ Digastric Muscle (Figs. 19.14, 19.15)

Origin

- Ventral head: digastric fossa on the backside of the symphysis menti
- Dorsal head: mastoid notch on the mastoid process

Insertion

On the intermediate tendon that inserts laterally on the hyoid bone

Action

- Lifting the hyoid bone
- Pulling the mandible forward
- Supports the process of swallowing

Innervation

- Ventral head: mandibular nerve (trigeminal nerve)
- Dorsal head: facial nerve

Trigger Point Location

The trigger points are palpated along the course of the muscle as hypersensitive points medial to the SCM muscle.
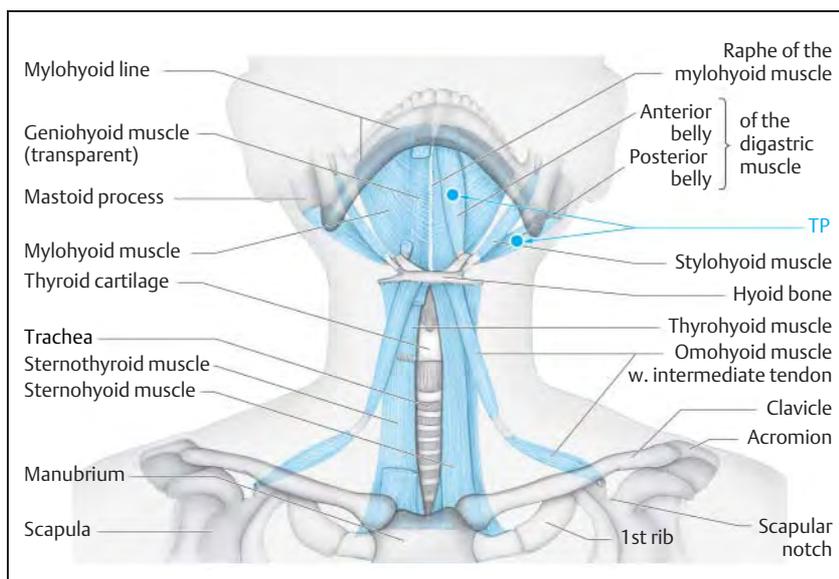
Mylohyoid line

Geniohyoid muscle (transparent)

Mastoid process

Mylohyoid muscle

Thyroid cartilage

Trachea
Sternothyroid muscle
Sternohyoid muscle

Manubrium

Scapula

Raphe of the mylohyoid muscle

Anterior belly

Posterior belly

} of the digastric muscle

TP

Stylohyoid muscle

Hyoid bone

Thyrohyoid muscle

Omohyoid muscle w. intermediate tendon

Clavicle

Acromion

Scapular notch

1st rib

Fig. 19.14

Fig. 19.15

Referred Pain

- Dorsal head:
  — into the upper region of the SCM muscle
  — occiput
  — neck region, near the mandible
- Ventral head: lower incisors and the mandibles underneath

Associated Internal Organs

None

■ Orbicularis Oculi, Zygomaticus Major, and Platysma Muscles (Fig. 19.16)

Orbicularis Oculi

Origin

Medial orbita rim, wall of the lacrimal sac

Insertion

Palpebral ligament

Action

Closing the eyelids, supporting tearing

19.3   Muscles of Elbow–Finger Pain

▪ Brachioradialis Muscle and Wrist Extensors

Brachioradialis Muscle
(Figs. 19.51, 19.52)

Origin

- Supracondylar crest of the humerus (upper two-thirds)
- Lateral intermuscular septum

Insertion

Styloid process of the radius

Action

- Flexion in the elbow joint
- Brings the forearm into medium position between supination and pronation

Innervation

Radial nerve (C5–C6)

Trigger Point Location

1–2 cm distal of the radius head on the radial side of the forearm approximately in the middle of the muscle belly

Referred Pain

- Back of the hand in the area between the saddle joint of the thumb and the basal joint of the index finger
- Lateral epicondyle
- Radial forearm

Associated Internal Organs

None

Extensor Carpi Radialis Longus Muscle (Fig. 19.53)

Origin

- Lateral supracondylar ridge of the humerus (distal third)
- Lateral intermuscular septum

Insertion

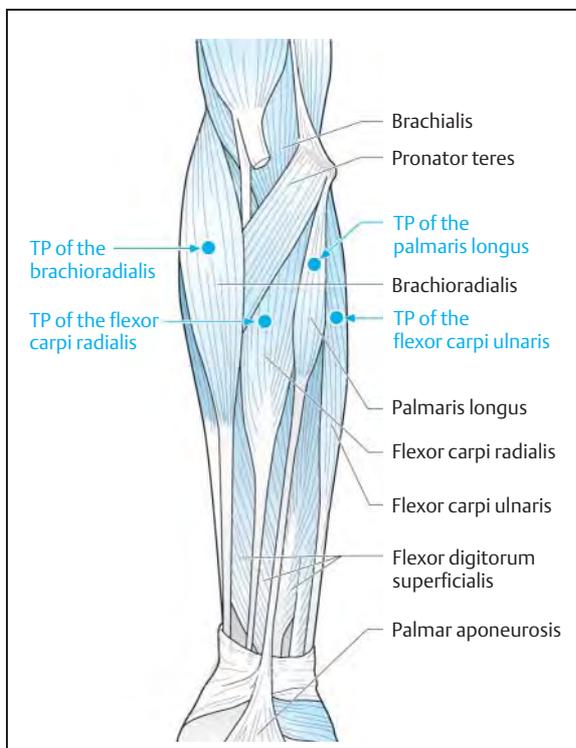Base of the metacarpal bone II (stretch side)

Brachialis
Pronator teres
TP of the palmaris longus
TP of the brachioradialis
Brachioradialis
TP of the flexor carpi radialis
TP of the flexor carpi ulnaris
Palmaris longus
Flexor carpi radialis
Flexor carpi ulnaris
Flexor digitorum superficialis
Palmar aponeurosis
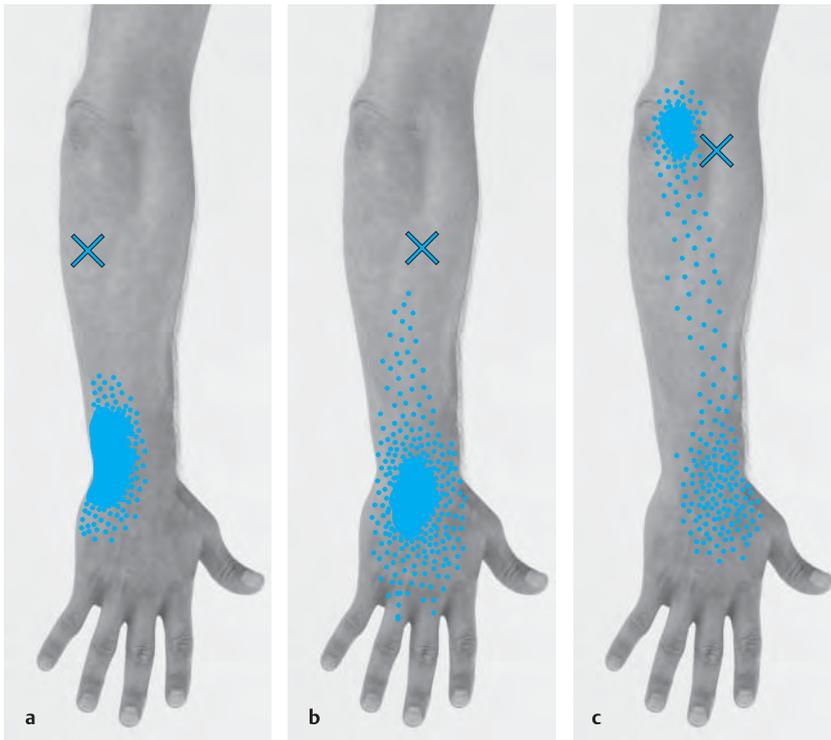
Fig. 19.51

Fig. 19.52

Fig. 19.53a–c

Action

Dorsal extension and radial abduction in the wrist

Innervation

Radial nerve (C6–C7)

Trigger Point Location

1–2 cm distal of the radius head, approximately at the height of the trigger point of the brachioradialis, but further ulnar

Referred Pain

- Lateral epicondyle
- Radial half of the wrist and back of the hand in the area of the metacarpal bones I–III

Associated Internal Organs

None

Extensor Carpi Radialis Brevis Muscle

Origin

Lateral epicondyle of the humerus (front side)

Insertion

Base of the metacarpal bone II (stretch side)

Action

Dorsal extension and radial abduction in the wrist

Innervation

Radial nerve (C7–C8)

Trigger Point Location

Approximately 5–6 cm distal from the radius head (roughly in the middle of the muscle belly) (see **Fig. 19. 53**)

Referred Pain

Central area of the wrist and back of the hand

Associated Internal Organs

None