Diagnosis: Cervical Spinal Stenosis

Cervical spinal stenosis, when severe enough, may result in myelopathy and thus may present in the medical office with signs and symptoms characteristic of such changes. The stenosis may be the result of congenital malformations or of progressive spondylotic changes. Due to the presumed risk of spinal cord injury, mobilization techniques would be contraindicated. Possibly the application of the NMT type 3 technique or manual cervical traction may be indicated as long as both are done very carefully and after the indications and contraindications have been weighed in the individual's presentation. If such manual treatment were to be undertaken it would only be done to address the secondary changes such as associated "muscle spasms."

Diagnosis: Acute Soft-Tissue Injury to the Cervical Spine

The techniques outlined may be utilized assuming there exist:

- No radiologic signs of instability.
- No objective neurologic deficit(s).

Mobilization-with-Impulse (Thrust)	Mobilization-without-Impulse	NMT Type 1	NMT Type 2	NMT Type 3
Mobilization procedures are typically not the technique of choice in the first 4–6 weeks following an accident that involves major mechanical trauma.		After the acute phase (i. e., after 4–6 weeks), the NMT type 1 technique may be well indicated for soft-tissue treatment of the cervical spine as long as a detailed structural examination reveals that: • There is no segmental instability, and • No exacerbations occur within hours of the provided treatment.	In the acute phase, NMT type 2 treatment is typically contraindicated. However, in practice, the NMT type 2 technique may be applied by an experience practitioner while assuring optimal fixation (stabilization) to the incriminated spinal region.	NMT type 3 procedure can be utilized soon after the trauma as long as localization and fixation are performed carefully.

Rest and medical and pharmacologic treatment with appropriately dosed and carefully applied passive physical therapy are the initial treatment interventions of choice in the first 2–6 weeks in trauma-induced cervical spine injuries, and as long as there are no objective neurologic and/or radiographic findings.

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Diagnosis: Chronic Phase of Soft-Tissue Injury to the Cervical Spine

The techniques outlined may be utilized assuming there exist:

- No radiographic signs of instability.
- No objective neurologic deficit(s).

Mobilization-with-Impulse (Thrust)	Mobilization-without-Impulse	NMT Type 1	NMT Type 2	NMT Type 3
Mobilization techniques may prove to be beneficial, if: • A prior trial treatment with NMT type 1 was successful. • The findings are clearly limited to a specific segmental or particular region (!). • Patient positioning can be accomplished without difficulty.		This technique may serve as a good preparatory technique for the mobilization techniques with and without impulse as well as for an individually tailored home training or exercise program.	The NMT type 2 procedure may be one of the treatments of choice in cases where there is significant muscular imbalance.	May be only necessary for acute exacerbations during the chronic phase.

Instability may be present if the patient continues to report symptoms, especially if there has been an initial trial treatment using manual medicine procedures tailored to the patient's individual clinical situation. It should be recalled that standard radiographs often may not be able to detect pathologic motion barriers or restrictions that are due to muscle dysfunction, for instance. They may therefore be interpreted as "normal," clouding the clinical picture, potentially leading to the false interpretation that there is no instability.

In response to a soft-tissue injury to the cervical spine a number of signs and symptoms typical of "soft-tissue rheumatism" may develop with various diagnostic entities described in the literature ranging from regional myofascial pain syndromes to cervical "sprain/strain syndromes," among many others. While some of the manual medicine techniques may be distinctly helpful in the treatment of the various tissue injuries, one should be very careful about their long-term use or potentially open-ended management using manipulative techniques. There always exists the risk of psycho-social-emotional problems including the patient's potentially becoming dependent on manipulative procedures, for instance, or other possible psychological changes.

Diagnosis: Cervicogenic Vertigo (Including Cervical Migraine)

Mobilization-with-Impulse (Thrust)	Mobilization-without-Impulse	NMT Type 1	NMT Type 2	NMT Type 3
Mobilization procedures with and without impulse are indicated, as long as: • The dysfunction is unequivocally segmental or regional. • Neurologic signs do not become apparent upon provocative testing (positioning, palpatory pressure). • Trial treatment using NMT type 1 was successful.		This is a well-suited technique for preliminary treatment and for teaching a home exercise program.	This may be a very useful technique especially in chronic situations in which there is demonstrated pronounced muscle imbalance.	This technique may be used in situations in which vertigo is exacerbated by different positioning. The reciprocal inhibition may be of benefit but exact localization and fixation are to be performed with utmost care.

Evaluation of vertigo often proves to be rather difficult. It may be necessary to consult a specialist who is familiar with functional disorders of the cervical spine as well as neurologic and otologic disorders.

Mobilization techniques and NMT type 1 and type 2 techniques are contraindicated when the vertiginous episodes are due to blood flow abnormalities in the vertebrobasilar area.

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3. **Proximal tibial osteotomy**
   (a) For better load distribution.
   (b) May be combined with arthroscopy.
4. **Arthroplasty**—especially if there is collapse of the tibial plateau.

Gonarthrosis or Osteoarthritis of the Knee: Surgical Considerations

Surgical treatment of the patient with demonstrated degenerative knee arthropathy (osteoarthritis/osteoarthrosis) falls into three major categories:

1. Arthroscopic debridement.
2. Corrective osteotomy/
3. Knee replacement: uni-, bi-, and tricompartmental.

Arthroscopic Debridement

- In gonarthrosis, results are more usually unsatisfactory than satisfactory, and especially in more advanced disease.
- Indications may include the following, but should be carefully weighed as to risk-benefit:
  – Osteophyte removal.
  – Subchondral cartilage treatment.
  – Meniscectomy.
- Debridement may be helpful during the early stages of gonarthrosis of the knee and/or when considering removal of well-demonstrated meniscal tears.

Corrective Osteotomy

(Fig. 14.**51**)

- This remains a valuable procedure as long as the appropriate indications are observed.
- Success rates are upward of 70% in 10-year follow-up.
- Valgus deformity: correction is proximal to the knee joint at the distal femur.
- Varus deformity: correction is distal to the knee joint at the proximal tibia.

Indications

- Determined by patient age and activity restrictions and outcome expectations.
- Unicompartmental degeneration must ensure that the patient is able to actively unload the involved leg.
- **Note:** concurrent arthrosis of the femoropatellar joint is *not* a contraindication to osteotomy; however, a diligent history and careful examination are necessary to differentiate between femoropatellar and femorotibial pain.

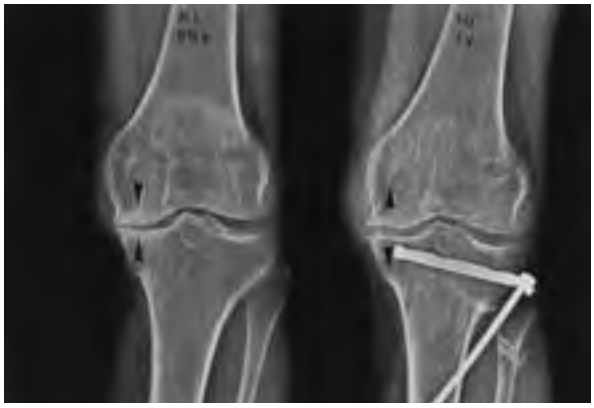

Fig. 14.**51** Valgus osteotomy of the proximal tibia to correct gonarthrosis that had resulted in a varus deformity. Surgical indications include unicompartmental degeneration with varus deformity; in order to undergo the surgical correction the patient must be able to shift his weight to the uninvolved side.
A wedge is removed from the lateral basis of the tibia. This redirects the mechanical axis from a medial position to the lateral compartment. The reduction of weight-bearing loads allows a reduction of the sclerosis at the condyle and the tibial plateau (Insall, 1993; Morrey 1996).

Recovery Period

- Six weeks to 6 months.

Complications

- Under- or overcorrection (the most frequent causes for treatment failure).
- Infection (especially with pins).
- Peroneal nerve palsy due to pin placement.
- Thrombosis/pulmonary embolism.

Knee Replacement

- The aim of procedure is pain reduction.
- 110° of flexion may be the best results obtained (135° would allow activities of daily living without any loss of function).
- The most important factor for successful result is being able to obtain as normal a mechanical axis as possible (a line that connects the centers of the hip, knee, and ankle).
- In the absence of particular complications, the new prosthesis should last at least 10–15 years, assuring functional abilities during that period.
- In selected cases, it may be possible to replace only one compartment that is affected (unicompartmental disease, either the medial or the lateral compartment).
- If the degeneration is massive with pronounced angular formation, it may be necessary to utilize a prosthesis with a long central stem in order to provide stability both anteroposteriorly and mediolaterally (Figs. 14.**52** and 14.**53**.

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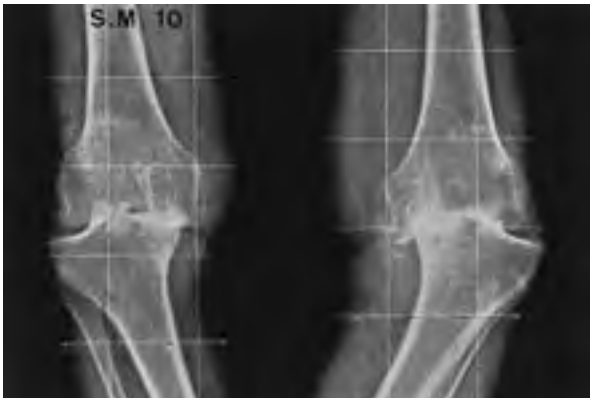

Fig. 14.**52** Advanced bilateral gonarthrosis. Due to loss in the medial joint structures, the knee undergoes a varus deformity. The medial axis no longer remains at the center of the knee joint as it is now displaced outside of the knee and more medial. The instability is due the loss in joint height medially while the lateral ligaments become stretched secondarily.

Fig. 14.**53** The goal of the arthroplasty is the restoration of as close to normal as possible an axis of motion and to maximize stability at the joint. The bone defect at the tibial plateau was corrected with an autologous bone graft. If it has been medially determined that there is no increased surgical risk, then the patient may undergo bilateral surgical correction at the same time.

Complications

- Deep vein thrombosis.
- Poor wound healing.
- Insufficient flexion motion (restricted): manipulation under anesthesia may be necessary in 10% of cases (if 90° of flexion has not been obtained within 2–3 weeks).

Residual Sequelae

- Postoperative pain, especially when the leg is at rest, may be an indication of infection.
- Pain with movement may be present for up to 6–12 months.
- Pain that becomes apparent years after the surgical intervention may be due to material degeneration or loosening of the prosthesis.

Further Reading

Jackson JL, O'Malley PG, Kroenke K. Evaluation of acute knee pain in primary care. Ann Intern Med. 2003;139:575–588.

Disorders of the Knee

Osteonecrosis of the Knee

Synonyms and Related Terms	• Avascular necrosis of the knee. • Osteonecrosis of the femoral condyle.
Key Points	• Sudden onset of medial knee pain. • Patient typically older than 60 years. • Knee motion is initially restricted in flexion and extension ("blocked"). • Hematoma medially. • Bilateral presentation in less than 20% of patients. • Potential for being mistaken for meniscal tear especially if initial radiographs are read as "normal" (compare with Fig. 14.**54**). • If suspecting this diagnosis, confirm with MRI or bone scan (Fig. 14.**55**).
Pathology/Etiology	• Early disease: slightly flattened condyle. • Late disease: cartilage fragments that emerge from the necrotic bone tissue with a new thin cartilage surface. • Arthritic joint degeneration of the compartment (stages I–V radiologically).
Clinical Presentation	• Severe medial knee pain with hematoma formation and joint "blockage" (joint is "locked up").

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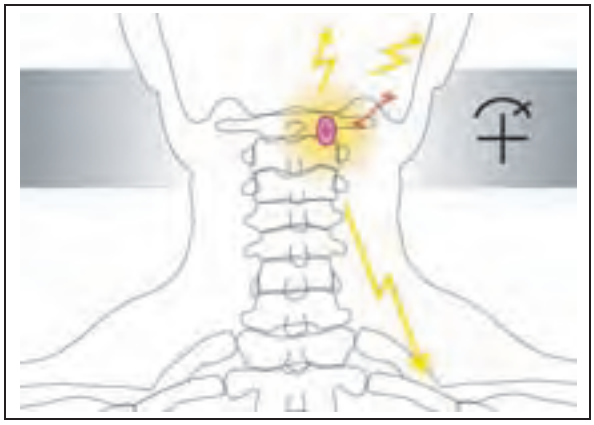
C1–C2

NMT 3: Rotation Restriction (with Upper Cervical Spine Fully Flexed) (Figs. I15.27a–e)

Indications

- *Pain:* Acute or chronic; localized to the neck region; may be radiating to the occiput and the temporal region, as well as the area between the shoulder blades (**a**).
- *Irritation zone:* C1–C2.
- *Motion testing:* Segmental rotation restriction (hypomobility) with soft end-feel.
- *Muscle testing:* The suboccipital muscles are shortened.
- *Autonomic symptoms:* Nonsystematic vertigo, which may be exacerbated upon palpatory pressure (**a**).


a

Patient Positioning and Set-up

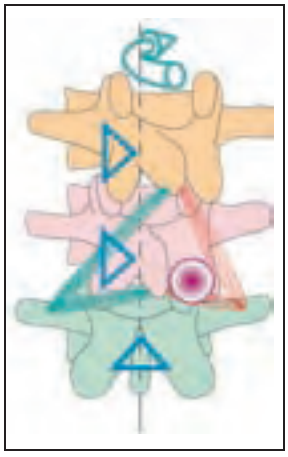
- The patient is seated.
- With the upper cervical spine maximally flexed the incriminated C1–C2 spinal segment is guided by the physician to its pathologic motion barrier.
- The spinal segments distal to the C1–C2 spinal segment are fixated through the physician's stabilizing hand by carefully introducing sufficient, albeit slight, side-bending in the direction opposite of that of induced rotation.
- The cervical spine is guided to its anatomic position or to the present neutral (resting) position.
- The other hand, the "treatment hand," cradles the patient's chin.

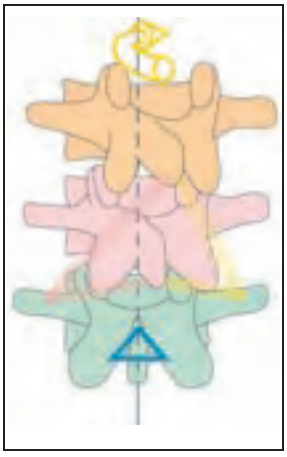

b


c

Treatment Procedure

- During inhalation, the patient is requested to perform an isometric contraction toward the pathologic motion barrier (**b, d**). At the same time, the patient is requested to look in the direction opposite that of the motion restriction.
- During the postisometric relaxation phase, the patient is requested to look in the same direction as the pathologic barrier (direction of intended mobility gain = direction of intended improvement).
- The physician then follows the newly gained rotation (beyond the pathologic barrier) while guiding the head passively in a lateral direction. It is important not to release the stabilizing hold on the neighboring spinal segments so as to maintain their fixated/engaged position (**c, e**).


d


e

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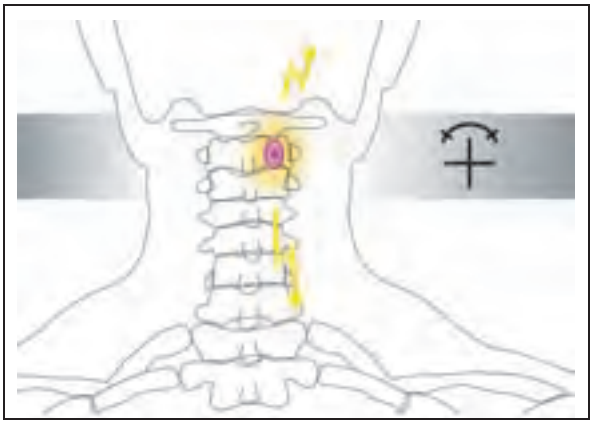
C2–C3

NMT 2: Rotation Restriction (Figs. I15.28a–e)

Indications

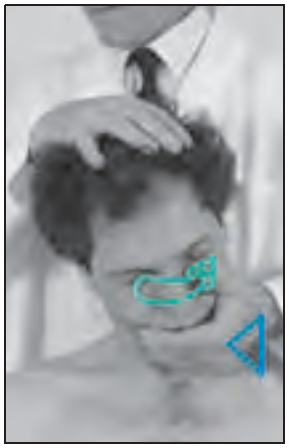
- *Pain:* Acute or chronic; localized to posterior neck region; pain may also be reported to radiate toward the jaw, the region of the hyoid bone, and the anterior neck region (**a**).
- *Irritation zone:* C2–C3.
- *Motion testing:* Segmental rotation restriction (hypomobility) while C0–C1 is maximally flexed (maximal inclination position); soft end-feel.
- *Muscle testing:* The hyoid muscles are shortened (**a**).


a

Patient Positioning and Set-up

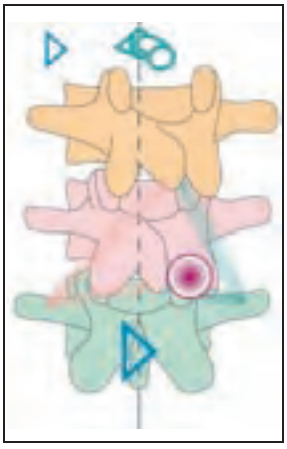
- The patient is seated.
- With the upper cervical spine maximally flexed, the incriminated C2–C3 spinal segment is engaged at its pathologic motion barrier by the physician.
- The spinal segments distal to the C2–C3 spinal segment are fixated through the physician's stabilizing hand by introducing some slight side-bending in the direction opposite of that of induced rotation.
- The other hand, the "treatment hand," cradles the patient's chin very carefully.


b


c

Treatment Procedure

- During inhalation, the patient is requested to perform an isometric contraction away from the pathologic motion barrier (**b, d**). At the same time, the patient is requested to look in the direction opposite that of the motion restriction.
- During the postisometric relaxation phase, the patient is requested to look in the same direction as the pathologic barrier (direction of intended mobility gain = direction of intended improvement).
- The physician then passively follows the newly gained rotation motion (**c, e**).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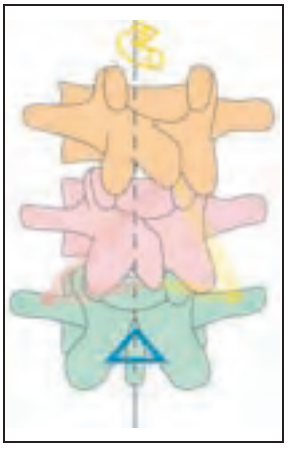
e

Comments

This technique is very well suited for the elderly patient. If pain or dizziness is reported during the isometric contraction, the NMT 3 technique may be an acceptable alternative. However, if the NMT 3 technique appears to cause similar symptomatology as well, then treatment should be halted altogether at that point.

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T12 through L5–S1

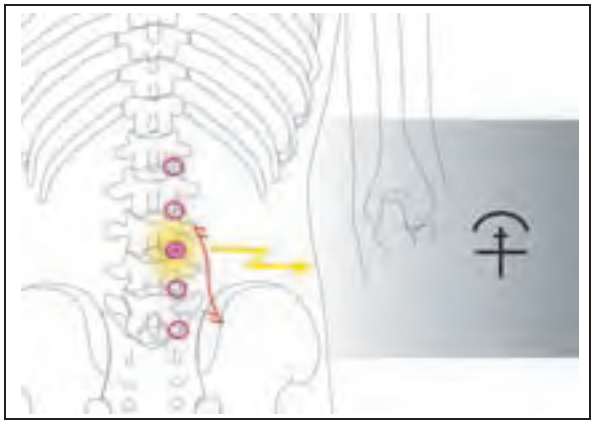
Mobilization without Impulse and Traction: Flexion Restriction (Figs. I15.89a–c)

Indications

- *Pain:* Chronic and localized; occasionally the pain may radiate to the lateral trunk (**a**).
- *Irritation zone:* T12–L1, L1–L2, L2–L3, L3–L4, L4–L5, L5–S1.
- *Motion testing:* Motion restriction (hypomobility) for the spinal segments between L1 and the sacrum (**a**).

Note: If there is hard end-feel during passive motion testing, one should apply mobilization without impulse. With soft end-feel during passive testing, one should apply NMT 2.

- *Muscle testing:* The erector spinae muscles in the lumbar region are often shortened.


a

Patient Positioning and Set-up

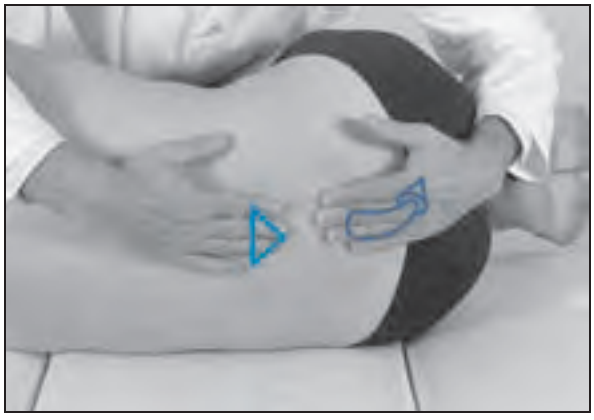
- The patient is in the side-lying position.
- The patient's hips are flexed and the lower legs rest against the physician's body.
- With his arms, the physician fixates the patient's thoracic and lumbar spine while his fingertips of one hand are placed over the spinous process of L5.
- The physician's other hand is placed over the spinous process of S1 and the entire sacrum.
- The restricted segment is localized and engaged by rotating the thoracic and lumbar vertebrae above the restricted segment (slack is taken out of the restricted segment) (**b**).


b

Treatment Procedure

Mobilization-without-Impulse Technique

- The physician introduces traction to the spinous process of S1, thereby effecting passive mobilization and flexing the spinal segment. The hip joints are flexed concurrently (**c**).


c

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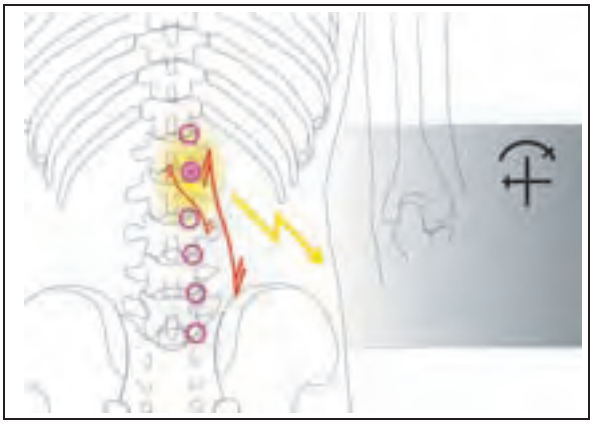
T12 through L5–S1

Mobilization without Impulse and NMT 2: Rotation Restriction (Figs. I15.90a–c)

Indications

- *Pain:* Chronic or acute; localized, often unisegmental or multisegmental (**a**).
- *Irritation zone:* T12–L1, L1–L2, L2–L3, L3–L4, L4–L5, L5–S1.
- *Motion testing:* Segmental rotation and side-bending motion restriction with hard or soft end-feel (**a**).
- *Remarks:* If the end-feel is hard, one should employ mobilization techniques without impulse, whereas in the event of a soft end-feel NMT 2 should be utilized.
- *Muscle testing:* The erector spinae muscles (lumbar portion) are shortened; the quadratus lumborum muscle may also be shortened.


a

Patient Positioning and Set-up

- The patient is in the side-lying position.
- First the vertebrae below, then the vertebrae above the restricted segment are rotated in order to exactly localize the restricted segment and to take out the slack.
- The physician fixates the superior vertebra of the restricted segment by placing his fingertips over the spinous process, the portion that is pointing away from the table.
- The physician then places his fingertips of the other hand over the spinous process of the inferior vertebra of the restricted segment. The point of fixation is the side close to the table (**b**).
- The spinal segment is subsequently guided to its pathologic barrier.


b

Treatment Procedure

Mobilization without Impulse

- The physician introduces direct traction to the inferior spinous process, thereby effecting passive rotation mobilization. The inferior vertebrae are simultaneously rotated while traction is employed (**b**).


c

NMT 2

- Isometric rotation is performed by the patient away from the restrictive barrier (during inhalation). During the postisometric relaxation phase, the mobilization procedure carries the segment beyond the pathologic barrier (during exhalation) (**c**).

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Rectus Femoris Muscle

Origin

This muscle arises from the anterior inferior iliac spine and the rim of the acetabulum of the hip joint (Fig. 17.**155**).

Insertion

Inserts at the base of the patella, within the medial and lateral retinacula of the patella (Fig. 17.**155**). It continues through the patellar ligament to insert also on the tibial tuberosity.

Course and Relations

The rectus femoris muscle is part of the quadriceps femoris system. Together with the vastus medialis, vastus lateralis, and intermedius muscles, it inserts via a common tendon at the patella. Some of the fibers of the vastus medialis and rectus femoris muscles form the medial retinaculum of the patella, whereas the fibers of the vastus lateralis and portions of the rectus femoris muscles form the lateral retinaculum of the patella. These retinacula then attach at the tibial condyles, bypassing the patella (Figs. 17.**155** and 17.**156**).

Action

Extension of the leg, flexion of the thigh.

Innervation

Femoral nerve (L2–L4).

Motor End Plates

The rectus femoris muscle is a nonpennate muscle whose fibers converge toward the insertion (Fig. 17.**157**). The motor end plates are arranged a curved line at the distal end of the muscle (Chomiak, 1993).

The vastus medialis and lateral vastus muscles are also nonpennate muscles whose fibers converge as well, but the end plates are arranged along a curved line (Fig. 17.**158**).

Palpatory Approach

This muscle is the most superior member of the quadriceps femoris group. It should not be difficult to localize the origin at the anterior inferior iliac spine. In contrast, the fibers that become part of the common tendon and the retinaculum of the patella cannot easily be distinguished by palpation.

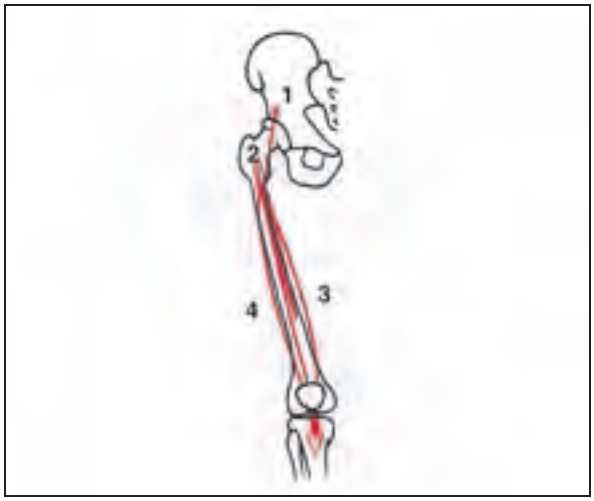

Fig. 17.**155** Quadriceps femoris muscle group.
1 Rectus femoris
2 Vastus intermedius
3 Vastus medialis
4 Vastus lateralis

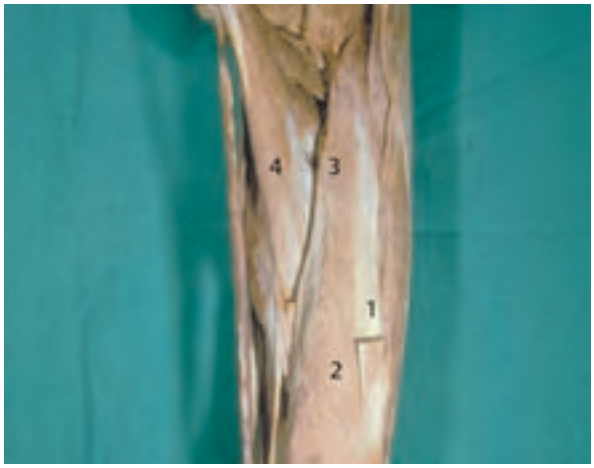

Fig. 17.**156** Superficial anterior thigh muscles.
1 Rectus femoris
2 Vastus medialis
3 Sartoriius
4 Adductor longus

Evaluation of Muscle Length of the Rectus Femoris Muscle

Procedure

The pelvis of the patient in the prone position is stabilized by one of the examiner's hand pushing against the sacrum toward the table. With his other arm, the examiner then flexes the patient's knee, introducing passive flexion, and monitors carefully any movement at the pelvic girdle (Fig. 17.**159**).

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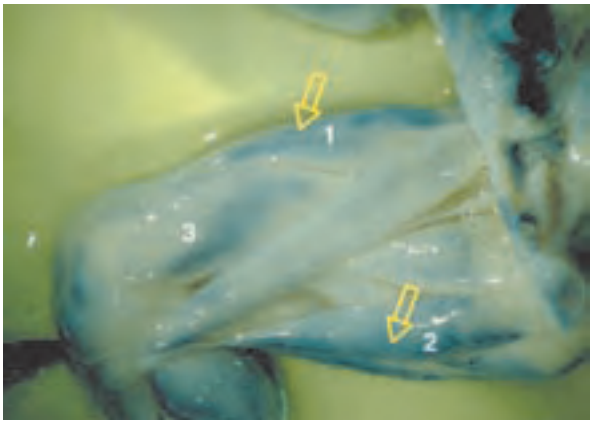

Fig. 17.**157** Motor end plates in the thigh muscles.
1 Rectus femoris
2 Adductor longus
3 Vastus medialis

Fig. 17.**158** Motor end plates in the thigh muscles (with kind permission of Dr. J. Chomiak).
1 Rectus femoris
3 Vastus medialis
4 Vastus lateralis

Fig. 17.**159** Length testing of the rectus femoris (patient prone).

Fig. 17.**160** Length testing of the rectus femoris (patient supine).

Positive Findings

1. With progressive knee flexion, the patient's pelvis on the tested side starts to lift off the examination table as a result of hip flexion. This is highly indicative of pronounced rectus femoris muscle shortening. The differential considers the possibility of lumboradicular irritation in the mid- or upper lumbar roots with a reverse Lasègue phenomenon.
2. The length of the rectus femoris muscle can be tested at the same time the hip flexors are being examined (iliopsoas muscle, tensor fasciae latae muscle). The patient's starting position is the same as that described for the iliopsoas muscle (see Figs. 17.**151**–17.**154**). After the examination of the iliopsoas muscle, the patient's knee is flexed further (passive flexion) (Fig. 17.**160**).
3. While knee flexion is being increased, the thigh continues to rise further above the horizontal line. When the rectus femoris muscle is shortened, flexion of the knee joint induces the hip to flex as well, in the form of a compensatory movement.

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18 Myofascial Trigger Point Treatment

Relevant physiologic and treatment principles for manual trigger point techniques have been described in Chapter 2.

Rectus Capitis Major and Minor Muscles (Figs. I18.1 a–c)

Indications

- *Pain referral pattern*: Occiput; temporal and parietal region on the same side as the incriminated trigger point (**a**).
- *Motion restriction:* Maximal flexion (inclination) at C0–C1 with the cervical spine extended is usually restricted.
- *Palpatory localization*: The rectus capitis major and minor can be palpated through the thin layers of the trapezius and splenius muscles. The muscle bellies are large and prominent. The trigger points (TPs) can only be assumed (**b**).

Patient Positioning and Set-up

- The patient is sitting.
- The physician stands behind the patient and introduces appropriate motion of the head and cervical spine.

Treatment Procedure

Technique I: Active, repetitive muscle contraction and relaxation. Compression of the trigger point (TP), while small flexion–extension motions are repetitively performed (**b**, **c**), specifically addressing the C0–C1 flexion (inclination) and extension (reclination) motions.

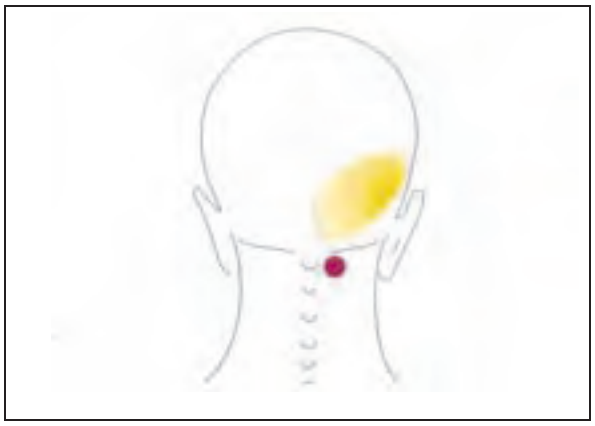
Technique II: Stroking massage of connective tissue. Localized stretching of the muscle portion containing the trigger point (at its painful location) following along the direction of the muscle fibers. The preparation/set-up stretch should not be excessive because otherwise one is unable to advance to the deeper trigger points.

Technique III: "Fascial release." Introduction of lateral stretch applied to muscle belly below the inferior nuchal line.

Technique IV: Myofascial release ("fascial separation"). Release ("separation") of the fascia between the following muscles: the suboccipital muscles and the area medial to the semispinalis capitis muscle and lateral to the border to the longissimus cervicis muscle.

Comments

In the presence of somatic dysfunctions with motion restriction at the C0–C1 and C1–C2 levels, address the suboccipital muscles before applying other maneuvers.



a

b

c

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Obliquus Capitis Inferior Muscle (Figs. I18.2a–c)

Indications

- *Pain referral pattern:* Pain may be localized to the suboccipital region; pain may also be referred to the temporal region (**a**).
- *Motion restriction*: Cervical rotation to the opposite side is restricted. The transverse process of the atlas (insertion) moves away from the spinous process of the axis (origin).
- *Palpatory localization*: The muscle can only be palpated when it is tight (e. g., "spasm") (**b**).


a

Patient Positioning and Set-Up

- The patient is seated upright with the head being rotated slightly to the opposite side.
- The physician stands behind the patient and monitors the patient's motion with one hand.


b

Treatment Procedure

Technique I: Active, repetitive muscle contraction and relaxation. The trigger point is compressed by the physician's finger, which pushes "through" the trapezius and splenius capitis muscles. The patient is instructed to repetitively rotate his head and neck to either side (**b**, **c**).

Technique II: Stroking massage of connective tissue. Localized stretching of the muscle portion containing the trigger point (at its painful location) following along the direction of the muscle fibers. The preparatory stretch should not be excessive because otherwise one is unable to advance to the deeper trigger points. Skin and underlying tissues should be treated simultaneously, that is, the skin should not be displaced with respect to the muscle.

Technique III: "Fascial release." Usually this technique cannot be applied to the obliquus capitis inferior muscle.

Technique IV: Myofascial release ("fascial separation"). Usually this technique cannot be applied to the obliquus capitis inferior muscle.


c

Notes:

- The trigger point treatment of the obliquus capitis inferior muscle is well suited as preparation for mobilization-with-or-without-impulse techniques directed to the C1–C2 articulation.
- The muscle can also be stretched utilizing the NMT 2 technique by introducing rotation at the C1–C2 level.

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