

Manual Physiotherapy of Fascia - Introduction to Myofascial Release and Fascial Manipulation

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1. Abstract

Fascia is formed from a superficial fascia, a deep fascia, a perimysium fascia, a perimysium fascia, a endomysium fascia. There are 6 Center of Coordination (CC) on a perimysium fascia. There are 8 Center of fusion (CF) on a deep fascia. When these abnormalities occur, fascia densification, substrate gelation, and hyaluronic acid aggregation occur. Fascial dysfunction spreads over a wide range through the deep fascia, and the past history often becomes a problem. Treatments for this fascial dysfunction include Muscle Pain Relief, Myofascial Release, and Facial Manipulation. This time, I will explain about Myofascial Release and Fascial Manipulation with case examples.

2. Fascial Dysfunction

Fascial degeneration can be caused by various factors.

Table 1: Causes of fascial degeneration.

Mechanical	Acute: sprain, fractures, direct trauma. Chronic: excessive use, posture, work, sports.
Physical	Temperature: heat, cold, wind, humidity Mental strain: anguish, conflict, depression.
Chemical	Nutrition: overnutrition,

	unbalance, addiction Endocrine: hormones.
Infection	Metabolism.
Immobilization:	Development of abnormal small networks between collagen fibers Alteration of collagen turnover mechanics (synthesis and degradation). Cleavage of new collagen fibers Change in quantity and quality of amorphous substance due to reduced water and glycosaminoglycans (GAGs).

Injury, disuse, lack of exercise due to circulatory failure, repetitive movement and persistent poor posture can cause twisting of collagen fiber bundles and densification of the fascia, eventually leading to dehydration, hardening and gelation of the fascial matrix. Aggregation of hyaluronic acid due to overuse and sustained muscle contraction can also limit myofascial gliding [1-3].

Generally, fascial dysfunction is caused by 1)

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densification of the fascia, 2) gelation of the fascial

matrix and 3) aggregation of hyaluronic acid. Fascial dysfunction reduces the gliding property and mobility of the fascia and all underlying tissues such as muscles, thereby limiting the maintenance of antigravity posture as well as smooth, functional and efficient movements.

Fascia is composed of the superficial fascia, deep fascia (aponeurotic fascia), epimysium, perimysium and endomysium.

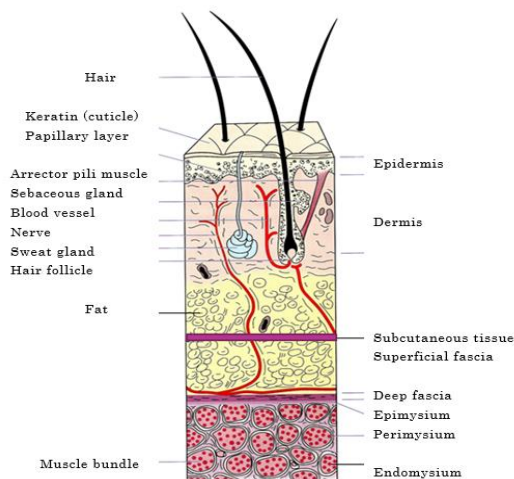


Figure 1: Superficial fascia, deep fascia, epimysium, perimysium and endomysium.

The superficial fascia is in the subcutaneous tissue while the deep fascia covers muscles and connects the whole body in 14 different arrangements. The epimysium is a thin membrane that covers muscles; it connects to the perimysium to cover muscle bundles and to the endomysium to cover muscle fibers. Muscle fibers enter from the epimysium into the deep fascia and connect muscles across joints along 14 different arrangements.

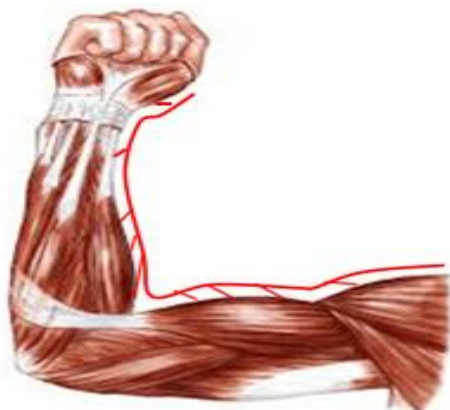


Figure 2: Muscle fibers enter from epimysium into the deep fascia.

Because the epimysium, perimysium and endomysium are connected to each other, muscle spindles attached to the endomysium are overactivated, resulting in increased alpha-motor neuron excitability. Moreover, poor gliding of muscle fiber results in reduced muscular flexibility and output.

All traction forces exerted by muscle spindles on the endomysium converge simultaneously on the epimysium. In the simplest fascial unit, traction forces are transmitted along the same muscle and converge on the midpoint. Even in a more complex fascial unit formed by many different muscle motor units, these forces converge on a single point.

This exact point on the epimysium where muscle force vectors converge is referred to as the center of coordination (CC).

The point where vectors from two adjacent fascial units converge in a multiplanar, diagonal, composite motion method (anterior-lateral, anterior-medial, rear-lateral, rear-medial) is referred to as the center of fusion (CF).

The human body can be divided into 14 segments: scapula (sc), humerus (hu), elbow (cu), carpus (ca) and fingers (di), which constitute the upper limbs; head (cp), neck (cl), thorax (th), lumbar (lu) and pelvis (pv), which constitute the trunk; and hip (cx), knee (ge), talus (ta) and toes (pe), which constitute the lower limbs. Abbreviations for body segments are written in Latin [1,2].

There are 6 arrangements of CCs and 8 arrangements of CFs connecting these segments; thus, at least one of these 14 arrangements are affected in fascial dysfunction.

The wavy collagen fibers of the epimysium and perimysium/endomysium connect to the tendon. When the tendon stimulates mechanoreceptors and nociceptors in a joint, the patient feels pain around the joint.

The area where the patient feels or perceives pain is referred to as the center of perception (CP).

Thus, therapists should be aware that the problem is not in the joint, but in the fascia.

Table 2: Body segments and terms used to represent their abbreviations.

Japanese	Latin	Latin	English	Anatomical parts included.
手指	DI	Digiti	fingers	Intercarpal and interphalangeal joints, interosseous muscles of the hand.
手根	CA	Carpus	wrist	Radiocarpal joint, extensor carpi radialis muscle, and extensor carpi ulnaris muscle.
肘	CU	Cubitus	elbow	Elbow joint, brachial fascia, biceps brachii muscle, triceps brachii muscle, brachioradial muscle.
上腕	HU	Humerus	shoulder	Glenohumeral joint, deltoid muscle, biceps brachii muscle, supraspinous muscle.
肩甲骨	SC	Scapula	scapula	Scapulothoracic and collar joints, trapezius muscle, serratus anterior muscle, rhomboideus muscle.
頭部	CP	Caput	head	Skull and temporomandibular joint, eye muscles, temporalis muscle.
Neck	CL	Collum	neck	Cervical spine, cervical fascia, iliocostalis cervicis muscle.
胸郭	TH	Thorax	thorax	Thoracic spine, thoracolumbar joint, iliocostalis thoracis muscle, pectoral muscles.
腰部	LU	Lumbi	lumbar	Lumbar spine, fascia, iliocostalis lumborum muscle, rectus abdominis muscle.
骨盤	PV	Pelvi	pelvis	Sacroiliac joint, pubic symphysis, gluteal muscles, abdominal oblique muscle, rectus abdominis muscle.
股	CX	Coxa	thigh	Hip joint, thigh, internal obturator muscle, pubic muscle, piriform muscle.
膝	GE	Genu	knee	Knee joint, femoral fascia, quadriceps femoris muscle, biceps femoris muscle
距骨	TA	Talus	ankle	Ankle joint (talocrural joint), lower leg fascia, gastrocnemius muscle, tibialis muscle.
足趾	PE	Pes	foot	Intertiparal and interphalangeal joints, fascia, interosseous muscles of foot.

Successful treatment of fascial dysfunction relieves muscle/fascial pain and improves muscular output/flexibility and motor paralysis, resulting in improved exercise performance and activities of daily living.

3. Treatment of Fascial Dysfunction

Treatment for fascial dysfunction includes muscle pain relief as an indirect approach and myofascial release and Fascial Manipulation® (FM) as direct approaches (Table 3).

General assessments include current history of pain and concomitant pain, detailed history taking, alignment, range of motion (ROM) during exercise, muscle strength, abnormal sensation and determination of the site of pain by palpation. Motion assessment (active/passive motion, stretching, resistance exercise) is then performed to determine whether there is any pain, ROM restriction and/or muscle weakness.

These assessments are combined with assessment of

CCs and CFs by palpation to assess each segment and arrangement.

Table 3: Therapeutic techniques for fascial dysfunction.

Procedure	Description
Muscle pain relief (MPR)	A myofascial treatment technique based on strain-counter strain with some original modifications developed by Takei taking into account the fascial arrangement. This technique is effective for relieving pain in center of coordination (CC) on epimysium where vectors of muscle strength converge, by having a patient passively take an easy posture that is least painful and thereby causing the muscle spindle to be shortened passively to reduce or suppress inappropriate proprioceptive activity.
Myofascial release	This technique is intended to influence the fascial tissue all over the body and aims to release and unravel twisted fascia, change the viscosity of the fascial matrix, and adjust muscular/fascial balance, rather than simply stretching the fascia. Concepts of CC and fascial arrangement have further improved its therapeutic effect.
Fascial manipulation® fascial manipulation®	Therapeutic targets are the CC and the center of fusion (CF), which is a wider region or a point where forces from multiple fascial units converge. For a densified CC, assessment and treatment should be performed along the fascial arrangement. Take sufficient time to rub each CC to correct the viscosity of matrix. Balance between agonist and antagonist muscles should also be taken into consideration. CFs are involved in the coordination of complex movements. Assessment and treatment should be performed along the diagonal and spiral fascial lines. Apply lower pressure than for CCs to increase friction glide.

Balance between agonist and antagonist muscles should also be considered when performing treatment.

4. Myofascial Release (MFR)

The purpose of MFR is to restore the normal function of muscles and other structures by reversing fascial twisting and to improve the mobility and stretchability between muscles or between muscles and other structures.

The deepest fascial tissue forms a dural tube that wraps and supports the central nervous system and impaired dural mobility may limit the physiological movement of the skull and sacrum, causing various forms of dysfunction [4-7]. Because the fascial tissue forms a systemic network, MFR is often combined with cranio-sacral therapy [4].

Although similar therapeutic techniques have traditionally been applied in osteopathy, the MFR technique described here was systematically established by John F. Barnes et al. and is intended to

release and unravel fascial twisting, rather than simply stretching the fascia [4,8-11]. Based on this technique, Takei et al. incorporated the concepts of CCs and fascial arrangement to establish their original therapeutic principles and techniques (Takei's concept). This modification has made MFR a more effective technique.

4.1. What is "Release"?

The objective of MFR, in particular, deep myofascial release, is to release densified and cross-linked collagen and elastin fibers and change the viscosity of the fascial matrix (intercellular material) from gel to sol. Barriers formed by the collagenous component cannot be corrected forcibly. Instead, applying gentle and sustained stretching and pressure can change the viscosity, or density of the matrix and release the restriction caused by collagen fibers, resulting in a change in tissue length.

First, apply pressure down to the deep fascia. Then,

while keeping the pressure, apply gentle stretching motions to the site of fascial restriction, causing the elastic component to be stretched by the initial stretch applied to the fiber complex. The elastic element is slowly pulled like an elastic or spring coil until the hand applying the stretch stops at a tough barrier formed by the collagenous component. It should be kept in mind that elastin fibers have shape-memory properties and if stretching stops here, they return to their original length due to elasticity.

Although barriers formed by the collagenous component cannot be corrected forcibly, applying sustained stretch can cause gradual stretching of collagen fibers due to the viscoelasticity of elastin fibers [2,6]. The stretched elastin fibers allow the tissue to regain its original shape and flexibility, resulting in restoration of the proper biomechanical alignment of the skeleton.

Barriers formed by the collagenous fibers cannot be corrected forcibly. Lower load (gentle pressure) is more effective than higher load (fast, pressure applied) in changing the viscosity of the matrix [4].

Applying gentle and sustained stretching and pressure over 90 seconds to 3 minutes (5 minutes maximum) can change the viscosity, or density of the matrix and release the restriction caused by collagen fibers, resulting in a change in the tissue length.

4.2. Precautions during release

After successful myofascial release, many patients experience an emotional change known as “somatoemotional release.” Just as emotional stress causes physical tension, physical stress causes emotional tension. Thus, releasing the fascial tissue from physical stress also results in emotional release [4,5,7].

4.3. Goal of myofascial release

The goal of myofascial release is to release fascial restriction and restore the overall musculoskeletal balance leading to a balanced posture. Acquisition of a structurally balanced posture will permit normalization of the center-of-gravity line and the

symmetrical functioning of the entire musculoskeletal system. Applying gentle stretching to the fascial restriction elicits heat, which is a vasomotor response that increases blood flow in the affected area, improves lymph drainage, reorganizes the fascial tissue and most importantly resets the sensory mechanism of soft-tissue proprioception [4,5-12].

This activity will reprogram the central nervous system, allowing a normal functional range of motion without eliciting old pain patterns [13].

The final goal is to achieve optimal function and performance with the least amount of energy.

Because this technique is mild, MFR is applicable to various signs and symptoms. Systemic contraindications include malignant tumors/cancer, aneurysms, acute rheumatoid arthritis and systemic/local infection; local contraindications include hematomas, open wounds, sutured wounds and fracture sites during the healing process.

4.4. Actual treatment procedure

The three basic MFR techniques are 1) longitudinal release, 2) transverse release and 3) pulling or traction.



Figure 3: Three basic techniques for myofascial release.

Longitudinal release is a technique used to stretch the fascia while gently applying pressure so as to sandwich the CC, taking into account the fascial arrangement and to keep stretching after feeling the restriction of elastin fibers until the restriction of collagen fibers is released and myofascial release is achieved.

Transverse release is a technique used to release the fascia on the transverse plane while simultaneously feeling the ventral and dorsal connections of the deep fascia.

Pulling is a technique that is used to easily move the upper or lower limbs in various directions while

releasing the fascia distally.

While performing release, the therapist should be relaxed and feel as if their palm or finger pulps were fused with the patient's skin.

While applying pressure down to the deep fascia while stretching the skin, the deep fascia is also stretched. In the initial phase of release, the elastic component is slowly pulled like a spring coil. Then, maintain the pressure for 90 seconds to 3 minutes (5 minutes maximum) to release the collagen component, causing the tissue to soften like melting butter. Pressure reaches the deeper layers gradually. The time required to complete the procedure will decrease with improved technique. Successful release will allow elastin, a constituent of elastin fiber, to help restore the original shape and flexibility of the tissue. The following part of this section describes representative treatment procedures for later motion (LA) of the upper limbs.

4.5. Representative treatment cases

4.5.1. LA-CX: Tensor fascia lata



Figure 4: Release of LA-CX (tensor fascia lata).

CC: Located inferior to the anterior superior iliac spine and on the tensor fascia lata.

CP: Pain in the lateral thigh around the tensor fascia lata. Numbness at a lower part of the lateral thigh.

Treatment position: Lateral position, with the lower leg placed forward and the upper leg placed slightly backward.

Place your hands crossed over the CC (cross-hand technique) to apply pressure and stretch.

4.5.2. LA-TA: Extensor digitorum longus (EDL)

CC: Located between the proximal one-third and

middle one-third of the lower leg, anterior to the fibula and on the EDL. Another located on the peroneus tertius.

CP: Pain in the lateral ankle. Pain secondary to ankle sprain.



Figure 5: Release of LA-TA (extensor digitorum longus).

Treatment position: Lateral position. Apply pressure and stretch to the EDL at the middle one-third of the lower leg (slightly above the mid-point) and anterior to the fibula.

5. Fascial Manipulation®

The therapeutic principle of FM consists of mechanical (movement - friction), physical (heat - inflammation) and chemical (metabolism - repair) elements [1-3]. The therapeutic targets are CCs and CFs.

CCs are located in the 6 fascial units that move various body segments in 3 spatial planes (anterior and rearward movements in sagittal plane, medial and lateral movements in frontal plane and internal and external rotation in horizontal plane). CFs are involved in multiplanar composite movements on diagonal lines and spirals (anterior-lateral [AN-LA], anterior-medial [AN-ME], rear-lateral [RE-LA] and rear-medial [RE-ME]). Differences between CC and CF are shown in Table 4. FM is also effective in evaluating and treating the musculoskeletal system affecting internal dysfunction, including visceral, vascular and glandular dysfunction; in treating sensory organs in the head, including the face; and in treating the superficial fascia for lymphatic/immunological, dermatological/ thermoregulatory,

fat/metabolism and neurogenic/psychogenic disorders [14].

Table 4: Differences between center of coordination (CC) and center of fusion (CF) [1,2].

CC	CF
Located on the muscle belly and coordinates fascial units through the epimysium, perimysium, and endomysium.	Located on the tendon and coordinates the motion method through the retinaculum and fascial spiral.
Located in body parts that correspond to the three spatial planes.	Located in the intermediate zone (diagonal line) between two planes near the joint.
Mobilized when force is required or when the muscle insertion into the fascia is tensioned (arranged).	Mobilized by retinacular tension applied either directly (via the tendon) or indirectly (via movement of the bone to which the retinaculum is attached).

An alternative treatment approach for lymphatic/immunological, dermatological/thermoregulatory, fat/metabolism and neurogenic/psychogenic disorders is to divide each of the trunk, upper and lower limbs into 4 areas (AN-LA, AN-ME, RE-LA and RE-ME) and treat the superficial fascia in each area.

5.1. Actual assessment procedure

Fascial dysfunction may occur on the fascial arrangements where fascial units in each segment involved in local pain are arranged on the frontal, sagittal and horizontal planes;

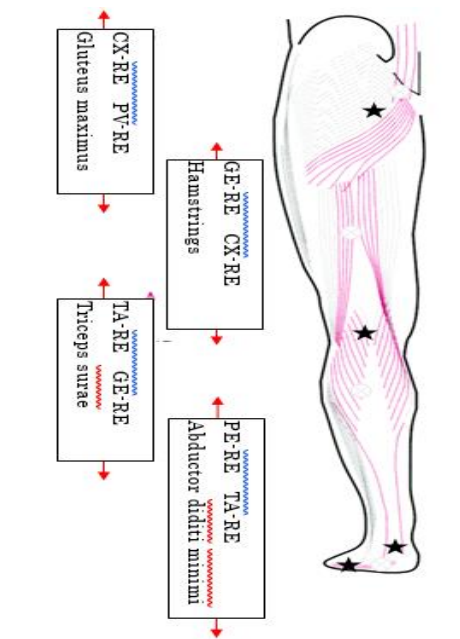


Figure 6: Example fascial arrangement: Sagittal view of the fascial arrangement involved in backward movement of the lower limb (adapted from reference 1 with some modifications)

Center of coordination: ⊗ Center of perception (site of pain): ★.

the fascial diagonal lines on these planes;

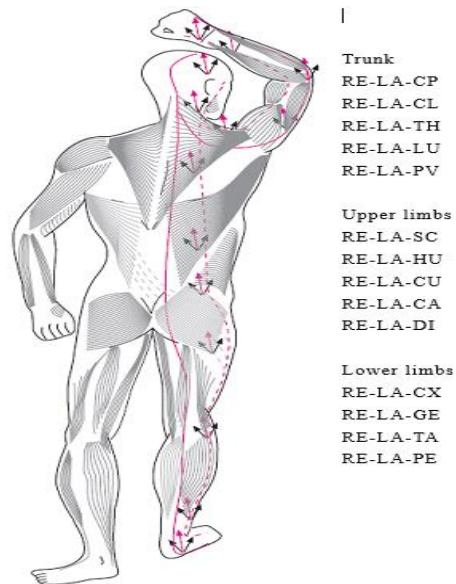


Figure 7: Example diagonal lines: Centers of fusion (CFs) on rear-lateral diagonal lines [2].

and the fascial spirals involved in extensive pain.

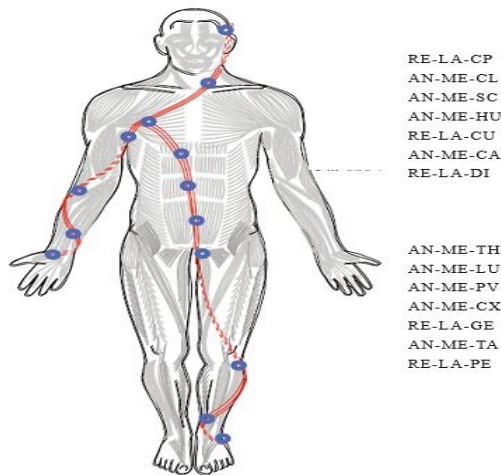


Figure 8: Example fascial spiral: A RE-LA (rear-lateral) spiral originating from the rear lateral aspect of the hand and foot [2].

Motion assessment is performed to assess the entire bone-nerve-myofascial complex or individual fascial units instead of individual muscles, by moving each segment in a specific direction. Each CC is located slightly away from their corresponding CPs and pain is only detectable on assessment by palpation. Based on the results of motion and assessment by palpation, it is necessary to identify densified and degenerated fasciae, treat the fasciae to reverse fascial degeneration and continue verifying hypotheses and results.

5.2. Actual treatment procedure

FM should be performed on a densified area that needs to be treated by applying deep pressure to the area (CC or CF) while applying friction for a sufficient length of time to generate heat. This heat helps correct the viscosity of the matrix and initiates inflammatory processes required for healing. This technique should be continued until fascial correction is achieved and pain resolves. Increased temperature promotes the gel-to-sol transition and results in a corrected fascial matrix. In general, the viscosity transition of a densified fascia can be achieved in several minutes.

Sudden release of free nerve endings results in reduced densified loci, leading to improved motor coordination, normalized joint motion trajectory and subsequent reduction of associated pain. This results in elimination of a fibronectin network that interferes with the functionality of CCs.

Immediately after treatment, patients may perceive improvement in symptoms and local warmth around the treated area. With no swelling, they feel even better than before treatment. A small depression due to change in loose connective tissue may occur in this area. After 10 minutes, some patients may notice worsening of symptoms and local pain. This is due to increased blood flow to the area and swelling formed as a consequence of the exudation phase. FM prevents matrix binding to allow for a new orientation of fibroblasts. During several hours after the fascial

inflammation phase, neutrophils appear following macrophages and are removed simultaneously with newly formed necrotic material. Myofibroblasts are activated and produce new type-III collagen fibers.

During the following 3 days, a small hematoma may appear at the treated area, which may worsen symptoms temporarily depending on predisposing factors. At this time, the use of anti-inflammatory compresses or medications should be avoided because they inhibit normal inflammatory reaction. Patients in good condition should also refrain from walking longer than usual or going shopping or to a fitness gym.

By 5 days after treatment, reduced local pain, improved fascial tension balance and resolution of symptoms and swelling should be observed. During the next 20 days, the initial type-III collagen fibers are gradually arranged along the traction line and are replaced by more stable type-I collagen fibers. It is important to inform patients in advance of the possibility of these reactions.

5.3. Example treatment cases

5.3.1. AN-GE: Lateral aspect of rectus femoris



Figure 9: Fascial manipulation on AN-GE (lateral aspect of rectus femoris).

CC: Located at half of the length of the thigh and on the vastus intermedius between the rectus femoris and vastus lateralis.

CP: Pain in the inguinal region and the medial thigh. Pain in the muscles attached to the pubic bone.

Treatment position: Supine. Apply pressure and friction with a knuckle or elbow placed on the fascia

lata in the lateral aspect of the rectus femoris between the patella and the inguinal ligament.

5.3.2. RE-PV: Iliocostalis lumborum



Figure 10: Fascial manipulation on RE-PV (iliocostalis lumborum).

CC: Located at the L5 level and medial to the posterior superior iliac spine on the quadratus lumborum muscle originating from the iliolumbar ligament.

CP: Pain at a site medial to the sacrum, piercing in nature, may diffuse along the posterior thigh/lower leg.

Treatment position: Prone. Apply pressure and friction with the elbow placed between the fifth lumbar spine and the anterior superior iliac spine.

5.3.3. RE-LA-LU: Latissimus dorsi

CF: Located at the center of the latissimus dorsi at the costal attachment of the upper margin of the serratus posterior inferior and the iliocostalis.

CP: Back pain occurs on torsion, lateral bending, or extension.



Figure 11: Fascial mobilization on RE-LA-LU (latissimus dorsi).

Treatment position: Prone. Apply a lower pressure

and a slightly broader friction than for CC treatment (fascial mobilization) to the center of the latissimus dorsi at the costal attachment of the upper margin of the serratus posterior inferior and the iliocostalis.

Three treatment techniques for fascial dysfunction were described.

Of these, muscle pain relief is an indirect treatment technique and is less effective than others for physical improvement of fascial dysfunction. Still, causing no inflammatory reaction, this technique is effective for persons with low pain threshold, children, the elderly and athletes scheduled to participate in an event on the same or following day.

Myofascial release and FM are both direct treatment techniques, although the former is more effective for those people sensitive to pain and those athletes scheduled to participate in an event on the following day.

FM is most likely to cause inflammatory reaction among these techniques and therefore requires sufficient patient orientation and accurate assessment. Therapists should also be able to select the most suitable technique for each patient.

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