
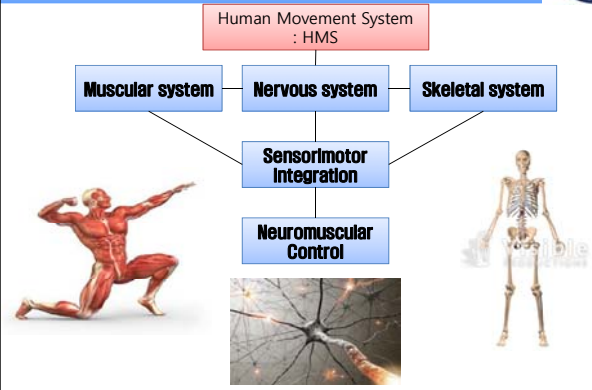


Dynamic Movement Assessment : Lower limb

B&C 스포츠 재활센터
권형준 ATC, CP




Introduction




```

graph TD
    HMS[Human Movement System : HMS] --> MS[Muscular system]
    HMS --> NS[Nervous system]
    HMS --> SS[Skeletal system]
    MS --> SI[Sensorimotor Integration]
    NS --> SI
    SS --> SI
    SI --> NMC[Neuromuscular Control]
    
```




Current Concepts in Functional Anatomy

- The **local muscular systems** consists of muscles that are predominantly involved in joint support or stabilization.
- The **global muscular systems** are responsible predominantly for movement and consist of more superficial musculature that originate from the pelvis to the rib cage, the lower extremities, or both.



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Local Muscular System (Stabilization System)



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Global Muscular System (Movement System)

Global muscular systems (movement systems)



- Deep longitudinal subsystem: **DLS**
- Anterior oblique subsystem: **AOS**
- Posterior oblique subsystem: **POS**
- Lateral subsystem: **LS**



DLS



AOS



POS



LS

Optimal human Movement ?



Length-Tension relationship



Couple Force relationship

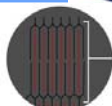
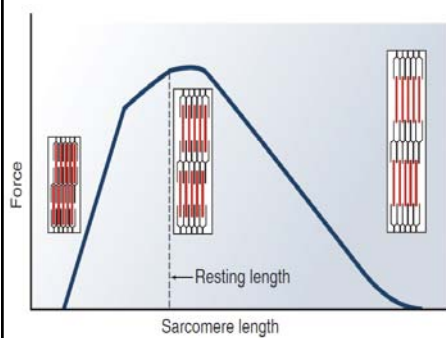


Arthrokinematics

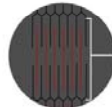


**Optimal Neuromuscular Efficiency
(Function)**

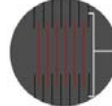
Length-Tension relationship



Shortening



Optimal

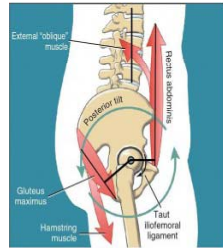
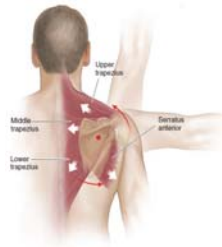


Lengthening

Force – couple relationship



- **Couple force:** The synergistic action of muscles to produce movement around a joint



Arthrokinematic



- **small amplitude motions of bones at joint surface**
 - roll
 - glide (or slide)
 - spin



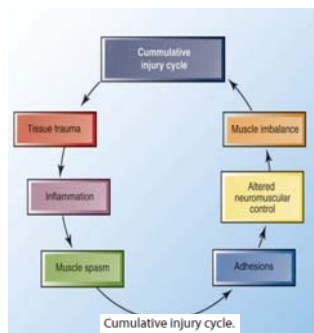
Movement system impairment



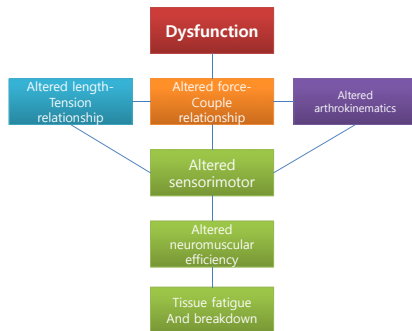
- Muscle tightness
- Muscle weakness
- Altered joint arthrokinematics



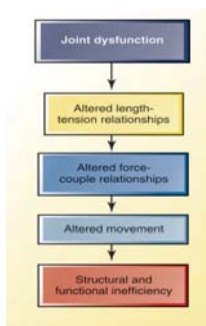
- Decreased performance
- Myofascial adhesions



Movement system impairment



Static malalignments



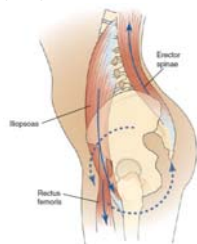
- Static malalignments may alter normal length-tension relationships
- Common static malalignments include **joint hypomobility** and **myofascial adhesions** that lead to or can be caused by poor static posture
- Certain muscles become tight (**alters the length-tension relationship**) or overactive (**alters force- couple relationships**) to prevent movement and further injury

Altered Muscles Recruitment



➤ **Altered reciprocal inhibition:** the process whereby a tight muscle (short, overactive, myofascial adhesions) causes decreased neural drive, and therefore optimal recruitment of its functional antagonist.

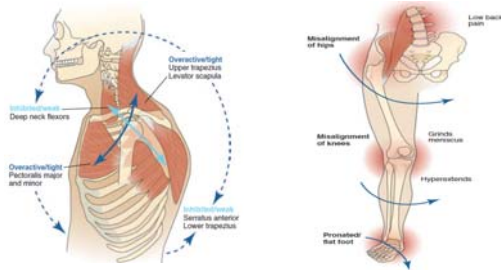
➤ **Synergistic dominance :** the process by which a synergist compensates for a prime mover to maintain force production.



Dynamic malalignment



- Upper extremity movement impairment syndrome
- Lower extremity movement impairment syndrome



Dynamic movement assessment



- Overhead squat
- Single leg squat
- Push up
- Standing cable row
- Standing overhead dumbbell press
- Star balance excursion
- Upper extremity assessments



The overhead squat – set up & Procedures



<set – up >

- Feet straight ahead
- Shoulder width apart
- Arms raised above their head as shown

<procedures>

- Perform a series of squats 5 times per view
- Squat to the depth of an average chair height

The overhead squat



Overhead Squat Views



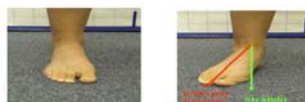
<check point>

1. Foot(ankle)
2. Knees
3. LPHC
(Lumbo-pelvic-hip complex)

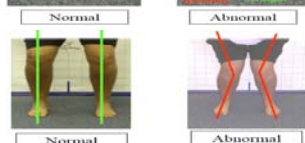
Anterior view



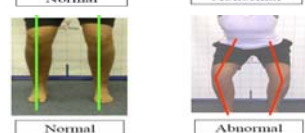
➤Foot turns out
(toe out)



➤Moves
Inward(valus)



➤Moves
Outward(varus)



Anterior view



View	Checkpoint	Compensation	Probable Over-active Muscle	Probable Under-active Muscle
Anterior	Feet	Turn Out	Soleus Lat. Gastrocnemius Biceps Femoris Tensor Fascia Lata (TFL)	Med. Gastrocnemius Med. Hamstring Gluteus Medius/Maximus Gracilis Popliteus
	Knees	Move Inward	Adductor Complex Bicep Femoris (short head) TFL Lat. Gastrocnemius Vastus Lateralis	Med. Hamstring Med. Gastrocnemius Vastus Medialis (VMO)
		Move Outward	Piriformis Biceps Femoris TFL Gluteus Medius Gluteus Minimus	Adductor Complex Med. Hamstring Gluteus Maximus

Posterior view



➤ Foot flattens



Normal

Abnormal

➤ Heel Raise



Normal

Abnormal

➤ LPHC: Weight Shift



Normal

Abnormal

Posterior view



View	Checkpoint	Compensation	Probable Overactive Muscle	Probable Under active Muscle
Posterior	Feet	Flatten	Peroneal Complex Toe extensor complex Lat. Gastrocnemius Biceps Femoris TFL	Posterior Tibialis Anterior Tibialis Med. Gastrocnemius Gluteus Medius
		Heel Rise	Soleus Gastrocnemius	Anterior Tibialis
	LPHC	Asymmetrical Weight Shift	Adductor Complex (on same side of shift) TFL Piriformis Bicep Femoris Gluteus Medius (on opposite side of shift)	Gluteus Medius (on side of shift) Adductor Complex (on opposite side of shift)

Lateral view



➤ LPHC: Low Back Rounds



Normal

Abnormal

➤ LPHC: Low Back Arches



Normal

Abnormal

➤ LPHC: Excessive Forward Lean



Normal

Abnormal

Lateral view



View	Checkpoint	Compensation	Probable Overactive Muscle	Probable Under-active Muscle
Lateral	LPHC	Excessive Forward Lean	Soleus Gastrocnemius Hip Flexor complex	Anterior Tibialis Gluteus Maximus Erector Spinae
		Low Back Arches	Hip Flexor Complex Erector Spinae Latissimus Dorsi	Gluteus Maximus Intrinsic Core Stabilizers
		Low Back Rounds	Hamstrings Adductor magnus Rectus Abdominis External Obliques	Gluteus Maximus Erector Spine Intrinsic Core Stabilizers

Progressing



OVERHEAD SQUAT OBSERVATIONAL FINDINGS				
View	Checkpoints	Movement Observation	Right - Y	Left - Y
Anterior	Foot	Turns out		
		Turns in		
	Knee	Moves inward Moves outward		
Posterior	Foot	Flattens Heel raise		
	LPHC	Weight shift		
Lateral	LPHC	Low rounds		
		Low arches		
		Excessive forward lean		

Progressing



Posterior	Foot	Flattens	
		Heel raise	
	LPHC	Weight shift	

- ROM test
- MMT
(Manual muscle testing)

compensation	Probable Overactive Muscles	Probable Underactive Muscles
flattens	Peroneal Complex Lat. Gastrocnemius Biceps Femoris (short head) TFL	Anterior Tibialis Posterior Tibialis Med. Gastrocnemius Gluteus Medius

- Overactive muscle (Myofascial release)
- Underactive muscle (Static stretch & isolated strength)
- Integrated dynamic movement(exercise)

