Muscle Activation deficits

Anil Bhave, PT
Director Gait Laboratory
Clinical Director Orthopedic Rehabilitation
Rubin Institute of Advanced Orthopedics
Sinai Hospital, Baltimore, Maryland

Athrogenic muscle inhibition
(AMI)

• What is AMI and what causes it?

Simple formula

Quadriceps Arthrogenic Muscle Inhibition: Neural Mechanisms and Treatment Perspectives
David Andrew Rice, BHSc,* and Peter John McNair, PhD†

Conclusions: AMI remains a significant barrier to effective rehabilitation in patients with arthritis and following knee injury and surgery. Gaining a better understanding of AMI’s underlying mechanisms will allow the development of improved therapeutic strategies, enhancing the rehabilitation of patients with knee joint pathology.

Arthrogenic muscle Inhibition

• Pain
• Joint effusion
• Age (Central activation deficit)
• Instability
• Habitual Limp leads to quads avoidance gait

Bhave 2017
CAR (Central Activation Ratio)
Age related

Mechanisms Underlying Quadriceps Weakness in Knee Osteoarthritis
STEPHANIE C. PETTERSON1,2, PETER BARRANCE3, THOMAS BUCHANAN4, STUART BINDER-MACLEOD2, and LYNN SNYDER-MACKLER


Habitual limp

Knee Flexion Lever Arm
What about tourniquet?

EMG changes in 18/25 patients post meniscectomy
- EMG changes temporary
- 16/18 resolved in 6 months
- Direct correlation exists between EMG abnormality and duration of tourniquet inflation and patient’s recovery time

Does Tourniquet Use in TKA Affect Recovery of Lower Extremity Strength and Function? A Randomized Trial.
Dennis DA1, Kittelson AJ, Yang CC, Miner TM, Kim RH, Stevens-Lapsley JE.
- Quad weakness 11.3 Nm for 3 months
- No effect on hamstrings
- Small difference in blood loss

Effects of tourniquet use on quadriceps function and pain in total knee arthroplasty.
Liu D1, Graham D2, Gillies K3, Gillies RM4.
- Increased pain in tourniquet group
- No difference in ROM, strength, Oxford Knee score
- Quad strength compromised up to 6 months as studied by surface EMG

Bottom line about tourniquet?
- More than 2 hours
- Max optimal pneumatic pressure 270 to 290 mm/hg

What are the long term effects of AMI
Functional Problems and Treatment Solutions After Total Hip and Knee Joint Arthroplasty

And Bhave, Michael Maas, Scott Tea, Michael Neiley, Roland Starr and Gisela Eismont

Quadriceps strength 98 OA (55 to 72 yrs.) compared to Fearon F (1989) data on 79 asymptomatic patients

Need for prehabilitation and rehabilitation in TKA

The Effect of a Prehabilitation Exercise Program on Quadriceps Strength for Patients Undergoing Total Knee Arthroplasty: A Randomized Controlled Pilot Study
Carly McKay, PhD, Harry Pappaevassili, PhD, Timothy Doherty, PhD
American Academy of Physical Medicine and Rehabilitation 1934-2432/12/33-655 ©2013 by the American Academy of Physical Medicine and Rehabilitation; all rights reserved; doi:10.1002/j.1532-2660.2013.01179.x; published online 26 October 2013

Muscle Strength Loss in the Lower Limb After Total Knee Arthroplasty

ABSTRACT
Use of Extension assist brace post TKA

NMES How strong Maximally tolerated

Physical Therapist

• Can we be Masters of Disasters?

Need to innovate because routine did not work well

Case 1

Arthrogenic muscle inhibition with ROM deficit
PCL, LCL, MCL complete and partial ACL rupture

Post reconstruction Infection
August 2013

Post Infection contracture
December 2013

Bracing and Therapy protocol

- EXT guardian brace all day long
- Removable extension splint all night
- PT 1-2 times a week
- NMES at home 2 times day in bed
- Hip strengthening in brace
- WALKING in guardian brace two crutches to one crutch to no device
Transitioned to
Guardian sports brace and
Sports specific PT

PT progress
May 2014

Return to non contact sports

Return to non contact sports

Sports specific performance
• Strength equal to the opposite side (Isokinetic testing)
• Single hop for distance with in 5 cms of normal
• Full ROM
• Lateral jump equal to opposite side
Case 2
Valgus knee deformity
beware of peroneal nerve

Functional training to improve knee flexion in gait

Post CKD and PT
Total Knee Arthroplasty

Typical peroneal nerve palsy
- Standard physical therapy
- Lower leg exercises
- Braces if required for pain

Peroneal nerve dysfunction
- Standard physical therapy
-時にブレースの使用
- Braces if required for pain

Case 4
Congenital Knee flexion contracture

Custom solution

Improved Gait
Case 5: Knee Flexion Contracture with Grade 2 Quads

Initial Rx

- BoNT –A, Hamstrings.
- Serial casting 1 week x 2.
- PT started 2 times a week after serial cast removal.
- Home NMES Unit
- Once a week TDN/IMT
- Walking brace fitting 2 weeks after PT start.
Initial brace fitting
40° KFC, 35° Quad Lag

Patient with 25° of knee flexion contracture and
Grade 3- quadriceps strength with 40°
active extension lag

Patient with 15° of Knee flexion contracture and
Grade 3- quadriceps strength with
40° active extension lag

Thank You
anilbhave@yahoo.com
abhave@lifebridgehealth.org