Muscle Strengthening – Lessons learnt from the Children!

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Myositis

- Juvenile Dermatomyositis
- Dermatomyositis
- Polymyositis

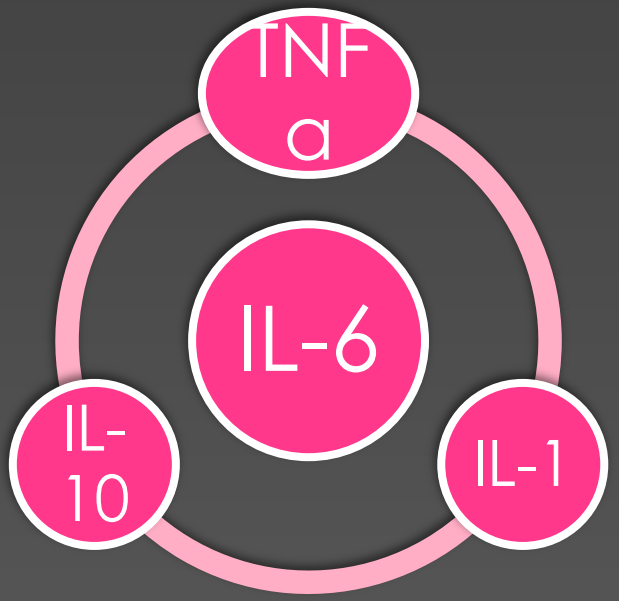
- Inclusion Body Myositis

Causes of Muscle Weakness

- Inflammation
  - Acute onset
- De-conditioning
  - Muscles loose strength within 24-48 hours
  - Maximum muscle strength lost in 1st 6 weeks
  - Muscles only recover with use.

Why Weaker Muscles?

- Pain
  - Inflammation
  - Biomechanical
- Reduced movement
- Reduced activity
- General 'un-wellness'
- Muscle imbalance
- Disease activity
- CYTOKINES



Petersen AM J physiol & pharm 2006; Mathur N Med of Inflamm 2008

Biomechanical Changes

- Inflammation is patchy
- Muscle imbalance
  - Strong muscles get stronger
  - Weak muscles get weaker
- Abnormal forces through joints
- Joint instability
- Fatigue

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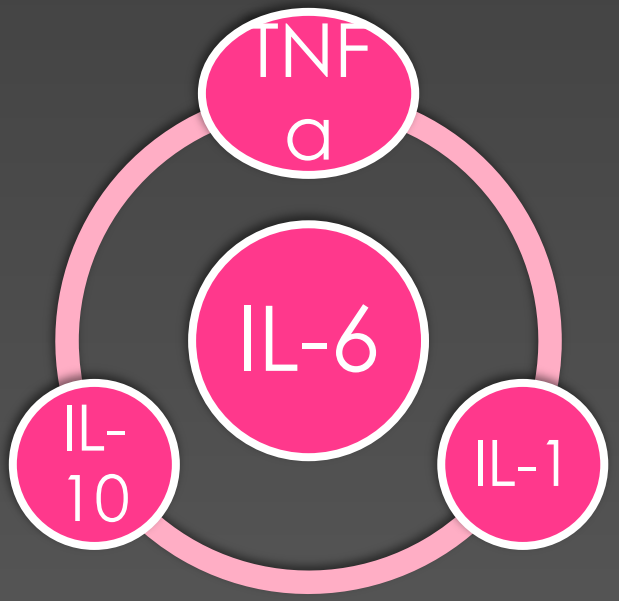

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TNFα

- **Inhibits contractile function**
  - Reduced contractile force
  - Blunts muscle response to calcium activation
- **Causes muscle atrophy**
  - Increases proteolysis
  - Inhibits insulin affect upon muscles
  - Blocks glycogen uptake in muscles
- Chronic increase:
  - Inhibits skeletal muscle synthesis
  - Causes skeletal muscle myopathy

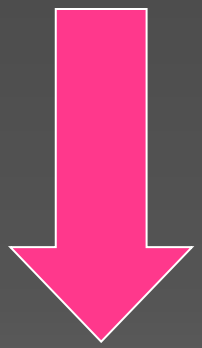
Yi-Ping Li and Michael B Reid; Current Opinion in Rheumatology 2001

Respiratory Research 2001

TNFa has a normal bi-phasic response in muscle growth

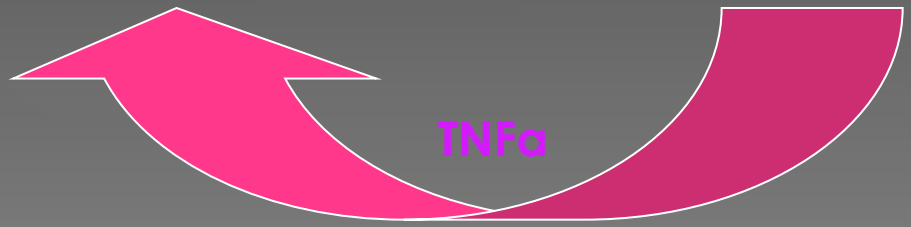
TNFa

Increase in MM cells



Mature MM cells

Apoptosis of mature cells



IL-6

- Pro-inflammatory cytokine
- **Normally produced by working muscles**

  Controlled by:
  - **TYPE OF EXERCISE**
    - Eccentric > Concentric
    - Endurance > resistance
  - Dependent on effort and time
  - Glycogen availability
  - Normal response

- Metabolism control
  - Glucose homeostasis
    - Insulin-stimulated glucose disposal
  - Lypolysis
    - Fatty acid oxidation

Pederson BK J appl physiol 103; 2007; Winkelmann C; AACN Clinical Issues, 2004

CYTOKINES and EXERCISE

- Excessive eccentric, endurance and strenuous exercise causes an increase in cytokine production:

  →Local muscle inflammation → Local muscle damage →degrading necrotising mm cells →

Muscle repair

Requires ↑Glycogen supplies

Moderate progressive resisted exercise programmes:

- Reduce normal production of:
  - IL-6
  - TNFa
- Improves the bodies homeostasis abilities
  - Efficient use of glycogen and Lipolysis
  - Less muscle inflammation (lower CRP)

(Kasapis C, J of Am Coll Cardiology 45; 2005)

AND THEREFORE ARE ANTI-INFLAMMATORY

Greiwe JS; FASEB J 2001, Castaneda C; Am J Kidney Dis. 2004. Gielen S; J Am Coll Cardiol. 2003 Perdersen BK; Pflugers Arch. 2003. Starkie R; FASEB J 2003

Muscle Repair

- Satellite Cells
  - Muscle precursor cells
  - Replace muscle cells
  - Increase number of muscle cells
  - Form new fibres or repair damaged segments
  - **Stimulated by exercise**
    - Daily exercise after damage encourages repair.
  - Finite number
    - Max no. @ birth, start to ↓ from 9 years

Common Pattern of Weakness in Most Conditions

- Hip Abductors
- Hip Extensors
- Inner range Quads
- Plantar flexors

Causes of Fatigue

- Inflammation
- Active disease
- Muscle weakness
- Specific muscle fatigue
- Deconditioning
- Reduced Aerobic fitness

- Emotional factors
- Psychological factors
  - Perception of illness
  - Perception of normal fatigue levels

To Explore the Use of the Paediatric QoL Subjective Questionnaire to Assess levels of Fatigue in children with JDM

A. Hasson et al – abstract published

- Parent reported PedsQL Fatigue did not correlate with disease activity
- Childs PedsQL Fatigue did correlate with disease activity
- FVAS correlated with disease activity
- There were a number of patients who reported high level of fatigue with no objective markers of disease activity
  - Need to consider psychological factors

Your Strength and Recovery

- Maximise what you can
  - Strength
  - Stamina – specific and general
  - Energy levels
  - Pacing
- Doing something is better than nothing!

Simple vs Complex Exercise

- **Simple Exercise (Correct biomechanics)**
  - **Hip abduction**
  - **Straight leg raise etc**

- Complex exercise (General fitness)
  - Walking
  - Running
  - Football

How to train muscles

- Specific muscles and Aerobic Training
- High repetitions
  - Less than 15 reps is not effective, ideal is 30 reps
- Low weights (0.5 – 5kg)
- Regular
  - 2x week better than 1x week, 4x week is best
- Regular progression
  - Daily/weekly is better than monthly

Faigenbaum AD, Rhea MR, Avery D, Hostler D and American College of Paediatrics

Home Management Programme

- Easy to do at home
- Progressive
- Specific
- Functional ?
- Not too long
- Once a day

Suggested HEP

- Straight Leg raises
- Hip Abductors (backward banana's)
- Hip Extensors
- Tiptoes 1 leg
- ? Core central stability

Knee Straightening

- Vastus Medialis

- Main protector of the knee
- Only extends the last 10 -20’ of extension
- The most important muscle for standing and walking straight.
- Easily inhibited
- Straight Leg Raise = most effective exercise

Hip Abduction

- Vital to stabilise the pelvis especially during walking
- Vital for core central stability
- Positioning is vital
  - Slight hip flexion enables Psoas to take over
  - Gluteus medius needs slight extension at hip
  - External rotation (turning hip out) also inhibits Psoas

Hip Extensors

- Power muscle for walking and climbing stairs
- Knee extended
  - Hamstrings and gluteus maximus
- Knee Flexed
  - Gluteus maximus only

Plantar Flexors (Tiptoes)

- Propulsion during walking and running
- Full strength is single leg stance
- Full stamina
  - 10 reps 1 leg full ROM

Exercises need to be progressed

Muscle Memory

It is important that the muscles increase:

STAMINA

STRENGTH

However these are lost after 6 weeks of no exercising! (De-conditioning)

If the strength training is maintained long enough (over 4 months) then the memory of the strength remains and regaining lost strength and stamina is easier.

Aerobic Fitness

- Specific exercises – high reps with weights
- Sport (care with biomechanics)
  - Reduced WB
    - Cycling / swimming / horse riding / rowing etc
  - Full WB
    - Walking (power) /Running / football / basket ball etc

Sport

- FUN
- Varied
- Any Sport
  - Trampolining?
- Pain afterwards if common and means you need to do more NOT LESS!

- NEED TO BE FIT FOR THE SPORT
  - Table tennis vs Rugby

Therapy Principals

- Progressive, resisted exercises to regain:
  - muscle balance
  - control of joint biomechanics
- Balance and proprioception education
- Functional activities
- Increase generalised stamina
- Increased confidence with own physical abilities:
  - In rehabilitation
  - With family

Maillard et al 2004, 2007, 2008, 2009, 2010; Engelbert 2003; Fatoye 2011

Thank
You
For
Listening
And
GOOD
LUCK