

Muscle Strengthening – Lessons learnt from the Children!

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Myositis

- ◉ Juvenile Dermatomyositis
- ◉ Dermatomyositis
- ◉ Polymyositis

- ◉ Inclusion Body Myositis

Causes of Muscle Weakness

- Inflammation

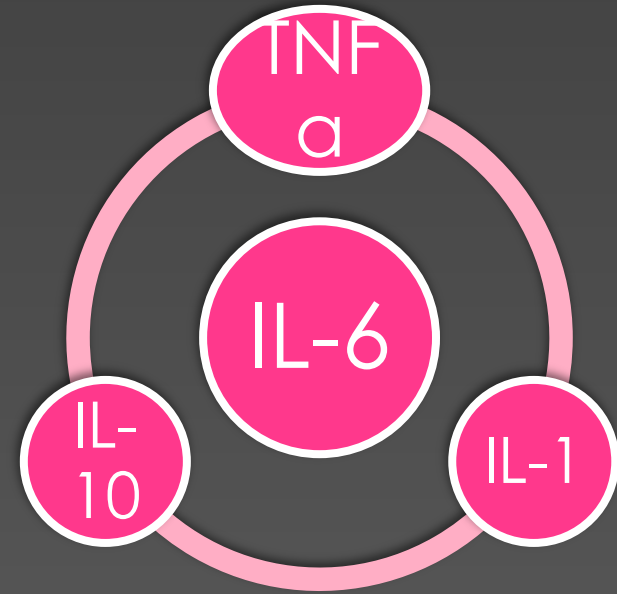
- > Acute onset

- De-conditioning

- > Muscles lose 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

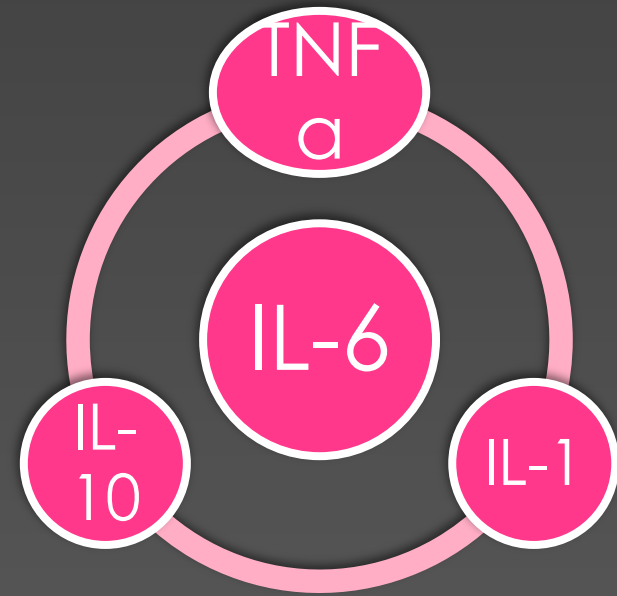


Biomechanical Changes

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

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TNF α

▶ **Inhibits contractile function**

- Reduced contractile force
- Blunts muscle response to calcium activation

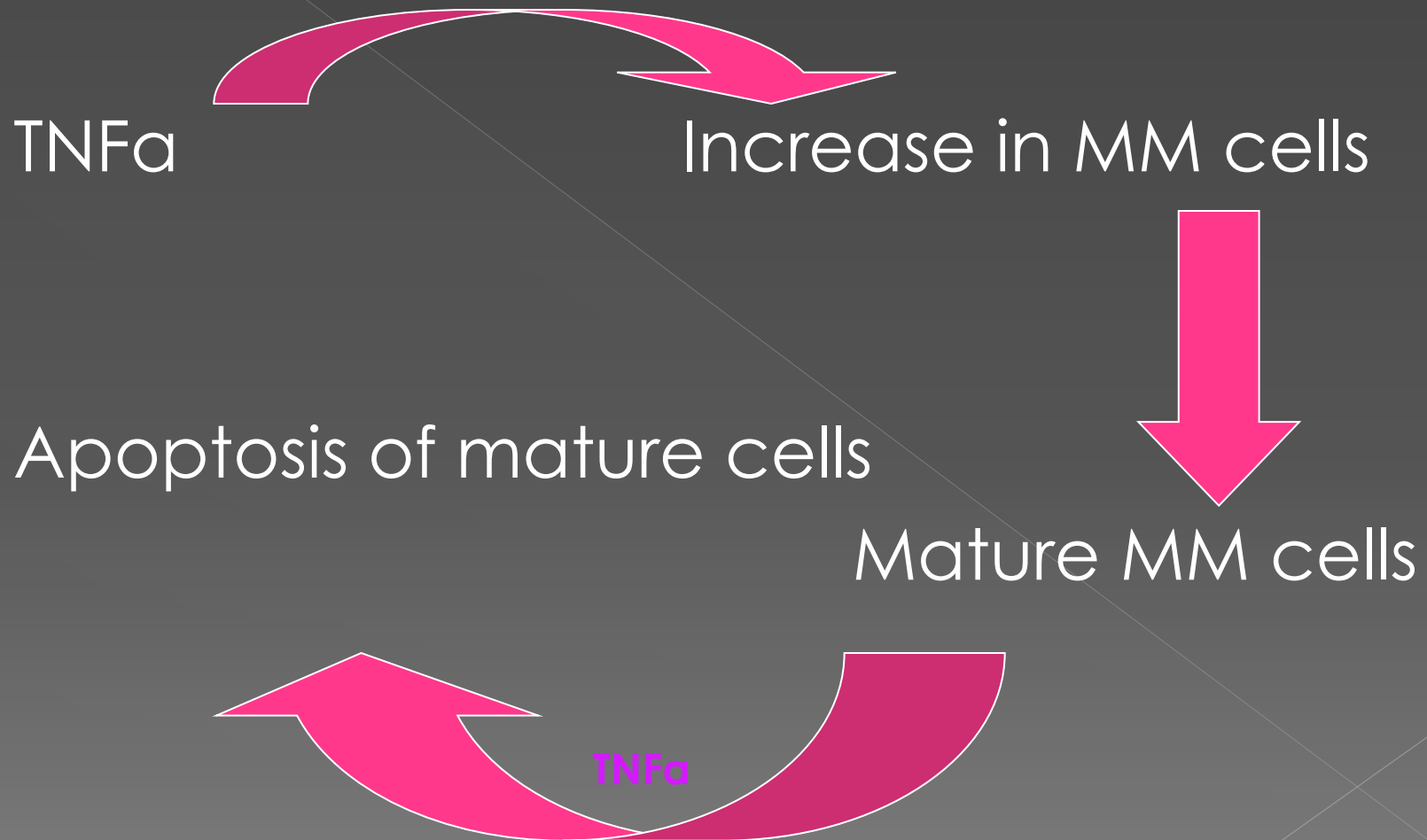
▶ **Causes muscle atrophy**

- Increases proteolysis
- Inhibits insulin affect upon muscles
- Blocks glycogen uptake in muscles

▶ **Chronic increase:**

- Inhibits skeletal muscle synthesis
- Causes skeletal muscle myopathy

TNF α has a normal bi-phasic response in muscle growth



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

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
 - > TNF α
- ▶ 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

Greive 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 is 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

**Thank
You
For
Listening
And
GOOD
LUCK**