What happens when you exercise?

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Myositis

- Juvenile Dermatomyositis
- Dermatomyositis
- Polymyositis

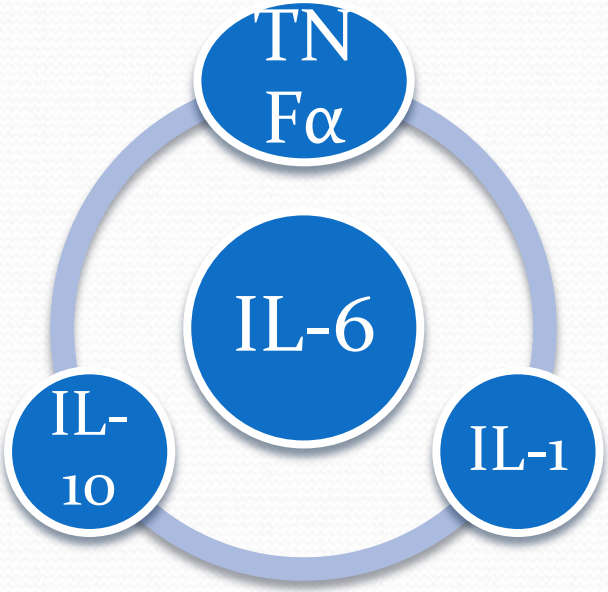
- Inclusion Body Myositis

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 - ? cause
- 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 muscle patterning
- Abnormal forces through joints
- Joint instability
- Fatigue

Why Weaker Muscles?

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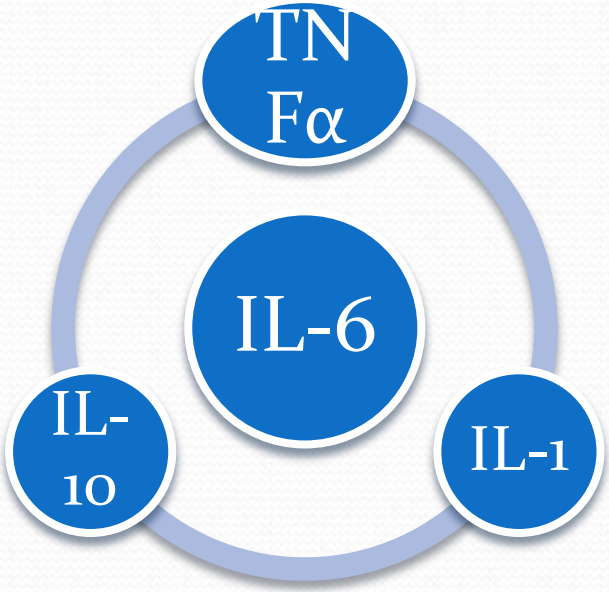
- **CYTOKINES**



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

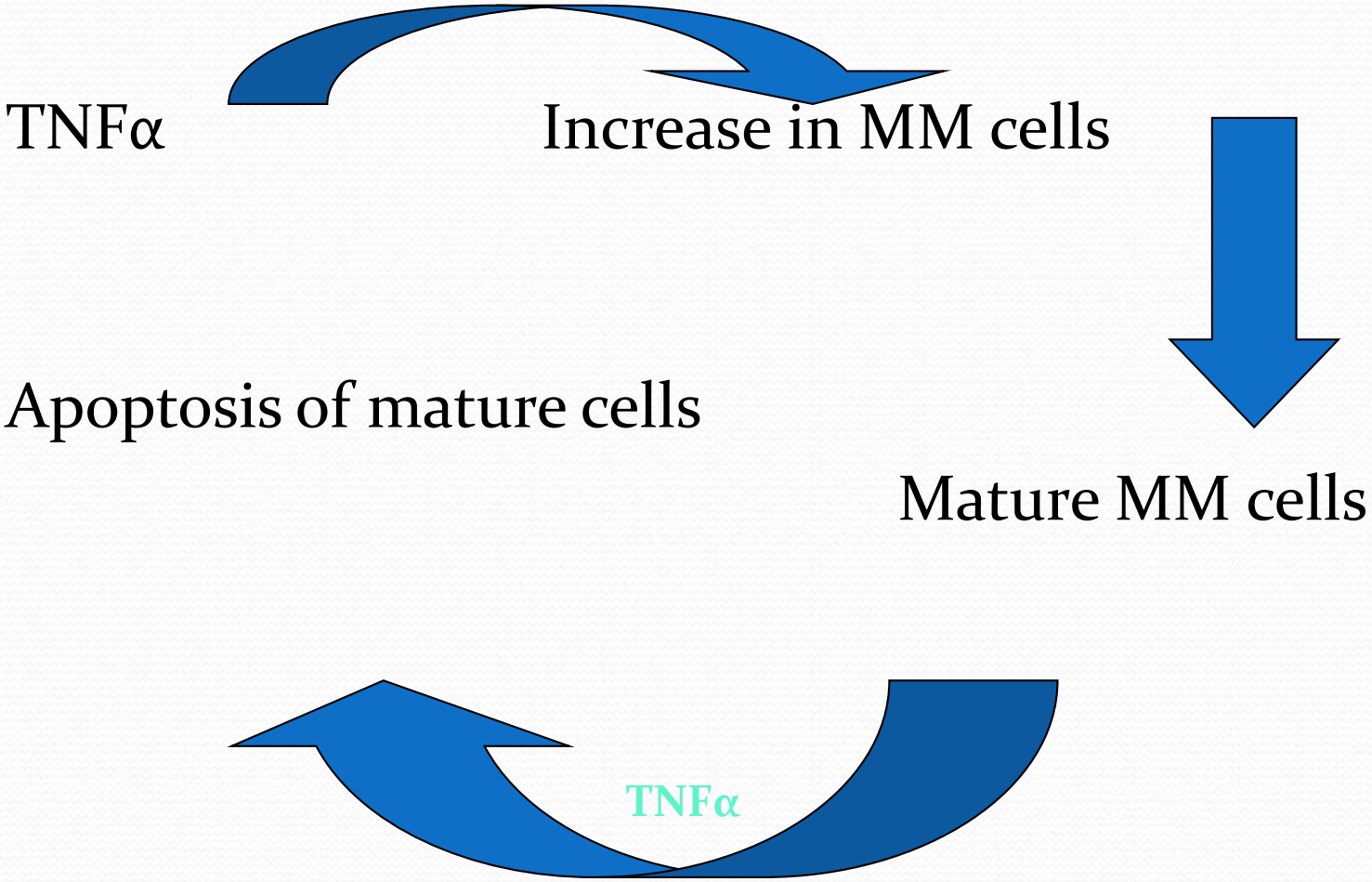
TNFα

- **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

TNFα has a normal bi-phasic response in muscle growth

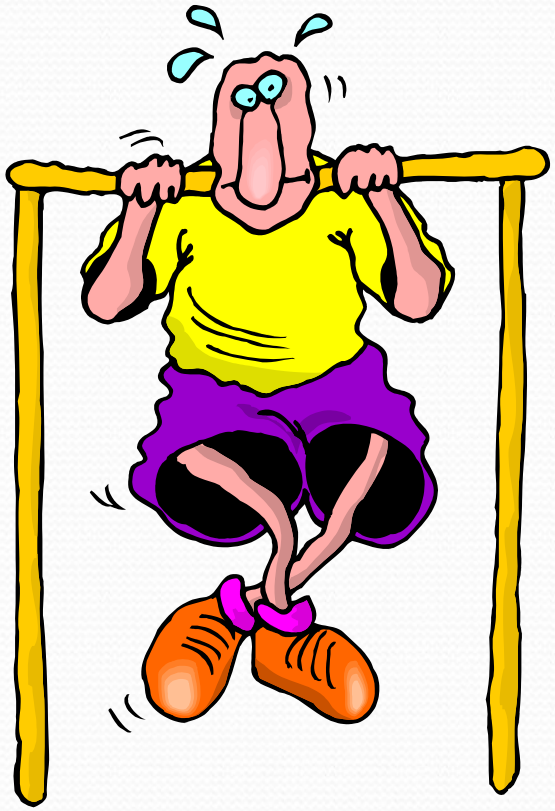


IL-6

- Pro-inflammatory cytokine – Delayed onset muscle pain.
- **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

Regular and moderately progressive resisted exercise programmes:

- Reduce normal production of:
  - IL-6
  - TNFα
- 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

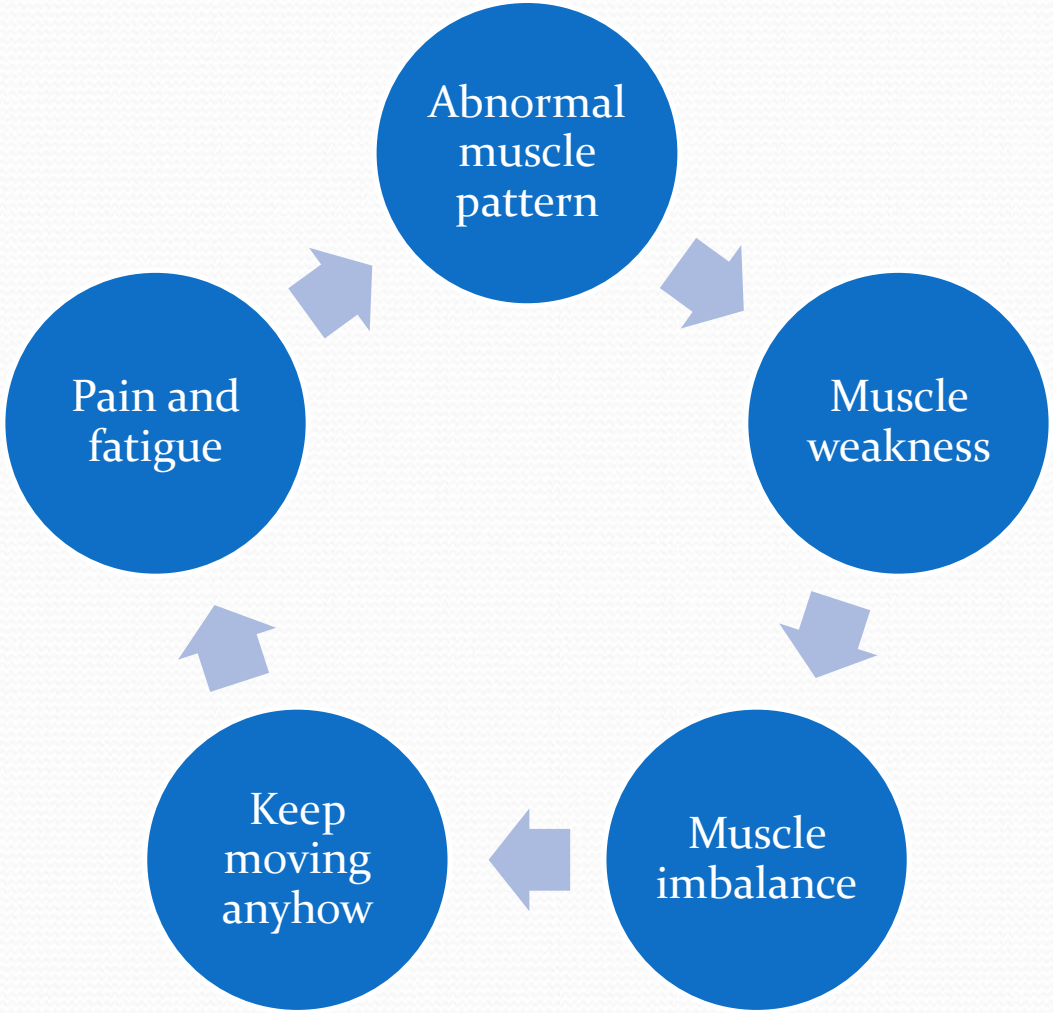
- Muscle imbalance
- Abnormal muscle patterning

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

Muscle Patterning



Your Strength and Recovery

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

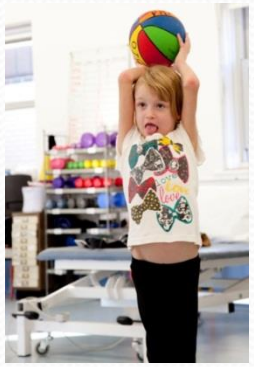
Simple vs Complex Exercise

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

- Complex exercise (General fitness)
  - Walking
  - Running
  - Static bike

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

Core Central Stability

- Strengthening abdominals and back extensors
- Reduce pressure on spine
- Modified positions
- High reps and progress
- Think about each and every step
- Think about standing

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
- Functional exercises
  - Sitting to standing
  - Stairs
- 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
  - That you also enjoy
- 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
- **Think about the movements**
- 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

What happens when you exercise?

Helene Alexanderson, Associate professor, PhD, RPT

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Disposition

- Metabolic milieu in muscle – why do muscles get weak?

- Effects of exercise in IIM
  - Disability and quality of life (QoL)
  - Disease activity and inflammation
  - Molecular effects in muscle tissue

Metabolic milieu in muscle

- Lactate is produced as a product of energy consumption in the muscle (the mitochondria).
- One study showed that individuals with established PM/DM had abnormally high lactate levels in blood following an incremental exercise bout compared to healthy controls indicating lower aerobic capacity locally in the muscle.
- Another study showed that there was no difference in lactate levels locally in muscle after an incremental exercise bout compared to healthy controls, but that the group of patients had markedly lower exercise capacity and whole-body aerobic capacity.
- Other factors contributing to muscle weakness could be: Lower levels of phosphocreatine in rest and during exercise, lower numbers of capillaries, swollen capillaries expression pro-inflammatory cytokine interleukin 1.

exercise program – all phases of disease

1. Warm-up

2. Shoulder mobility

3. Grip strength

4. Strength knee extensors

5. Strength shoulders

6. Strength hip extensors

7. Strength neck flexors and trunk

8. Strength hip flexors

- About 10 repetitions / task
- Combine with 20 min brisk walks 5 days a week

12 weeks home exercise – PM/DM

- Improved muscle strength (if you have pronounced weakness)
- Improve muscle endurance
- Improve aerobic capacity (if you add 20 minutes walks 5 days a week)
- Might reduce fatigue and improve quality of life
- Could reduce CK-levels, no signs of increased inflammation in muscle
- Increase proportion of type I fibers (oxygen dependent, endurance)

Deltoids

Quadriceps

Lat dorsi/biceps

3 sets of 10 repetitions
on 10 voluntary repetition maximum
(the weight you can lift 10 times but not 11, 70% of Maximal strength)

Gastrocnemuis

Trunk/neck

- Start on lower intensity
- Adapt to levels of fatigue, pain, corticosteroid dose, risk of osteoporosis

(Alexanderson et al. Arthritis Rheum 2007;57:768-77)

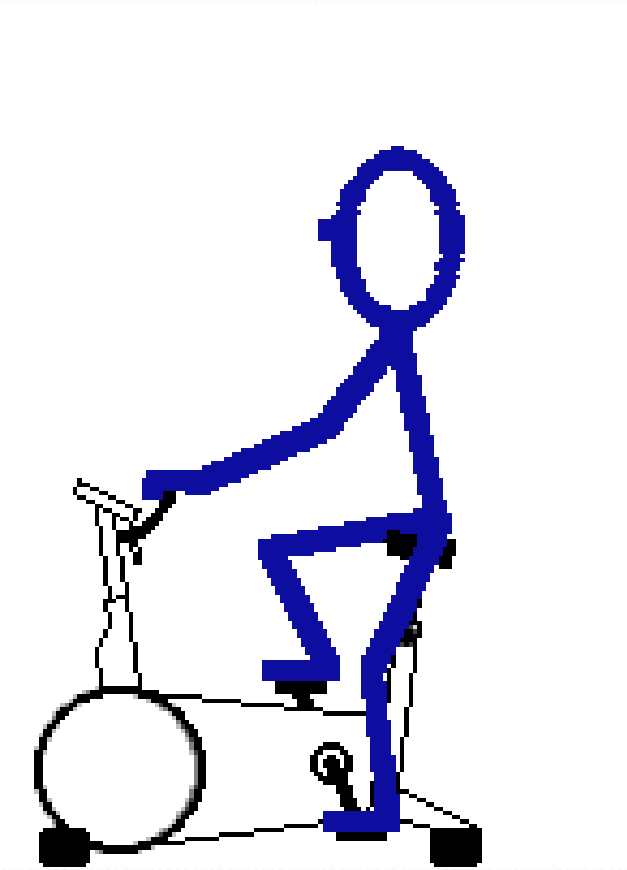
Intensive resistance training

- When exercising on 10 voluntary repetitions maximum 3 days a week for at least 7 weeks:
  - Improved muscle strength
  - Improved muscle endurance
  - Improved function in daily life
  - Reduced disease activity
  - Reduced inflammation in muscle
    - Down-regulation in genes regulating inflammation and fibrosis

Aerobic endurance exercise – low disease activity

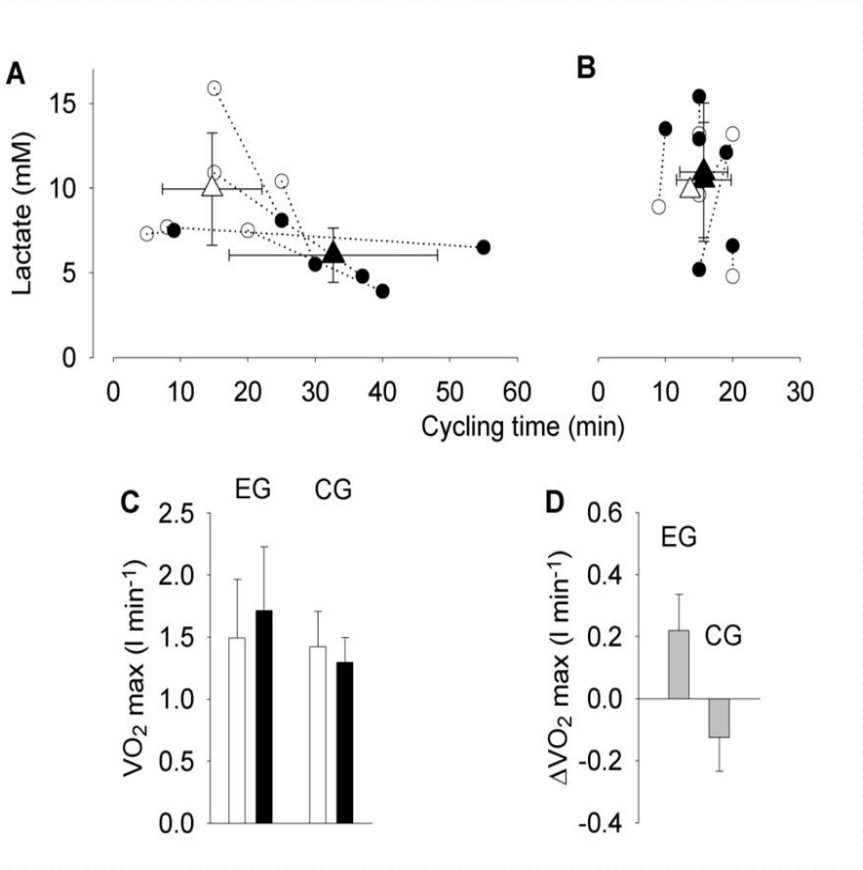
evaluated in randomized controlled trial comparing this exercise program to a non-exercising control group on a stable level of physical activity

- **Exercise program**
- 3 times/ w, 12 weeks
- 30 min cycling (load of 70 % of VO_2 max)
- endurance (30-40



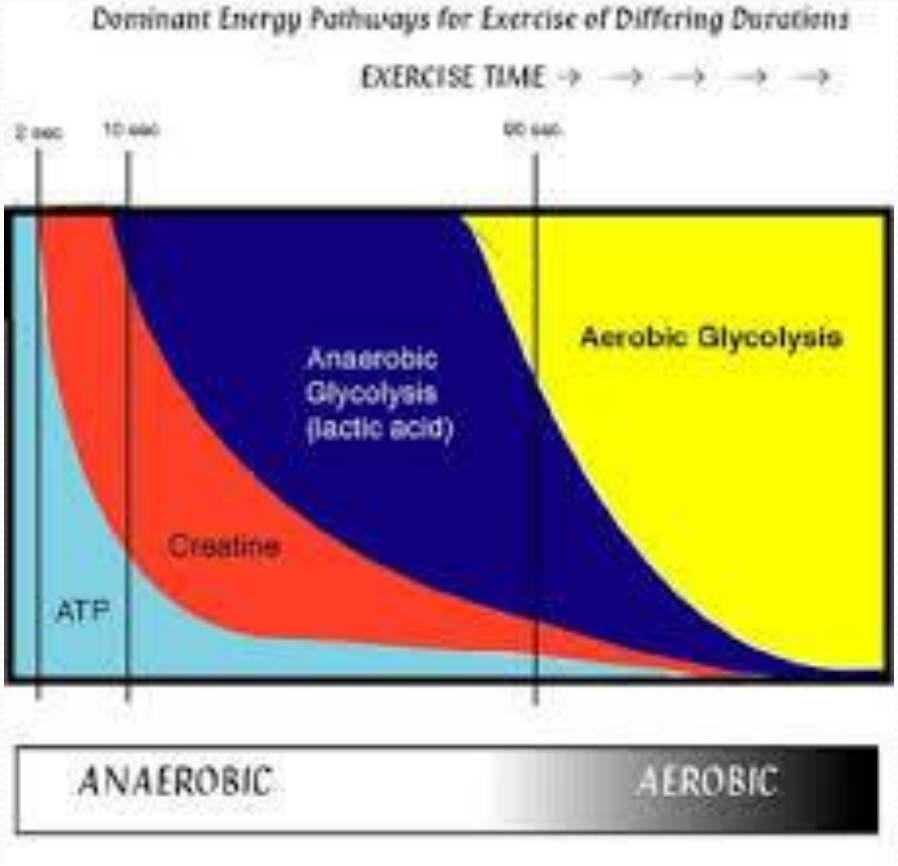
This program can:

- Improve whole-body aerobic capacity
- Reduce lactate levels in muscle and improve mitochondria function and increase numbers of capillaries in muscle
- Improve muscle strength and endurance
- Improve ability to perform daily activities



Creatine supplementation AND exercise in myositis

- Phosphocreatine (Pcr) is an important part of the muscle glycolytic (anaerob) metabolism
- Individuals with DM are reported to have low levels of Pcr
- Pcr is most important in the muscle energy system during the first seconds of exercise, but is still used to continue muscle contractions up to 2 minutes
- Five months creatine supplements combined with regular exercise (like home exercise) is more effective than exercise alone in established PM/DM.
- Talk to your rheumatologist before starting



Creatine dose

- Introduce creatine in addition to 2-3 days a week exercise
  - Could be any kind of resistance training alone or combined resistance and aerobic exercise
- Loading dose of 8 grams / day for 3 days
- Continue with a maintainance dose of 3 grams / day for 3 months
- Take a 4-week break from creatine and continue to exercise
- Start again with the maintainance dose for another 3 months and continue this cycle
- Creatine supplements can ONLY have positive effects on muscle function in combination with exercise
- If you don't exercise regularly – DON'T take creatine supplementations!

Home exercise program in IBM

Exercises	Preintervention	Postintervention
1. Whole body		
Sitting to standing (from standard height chair with arms)	3 sets of 6/day	3 sets of 10/day
2. Upper limbs		
Biceps curls*	2 sets of 10/arm/day	2 sets of 10/arm/day
Shoulder presses*		
Seated rowing (Thera-Band)		
Wrist flexion/extension*		
3. Lower limbs		
Calf raises (on tiptoe)		1 minute 2/day
Calf stretches (against wall)		15–20 seconds 3/day
Vastus medialis (isometric)		
Ankle dorsiflexion		2 sets of 20/day

*Holding a 375-g can of food in each hand.

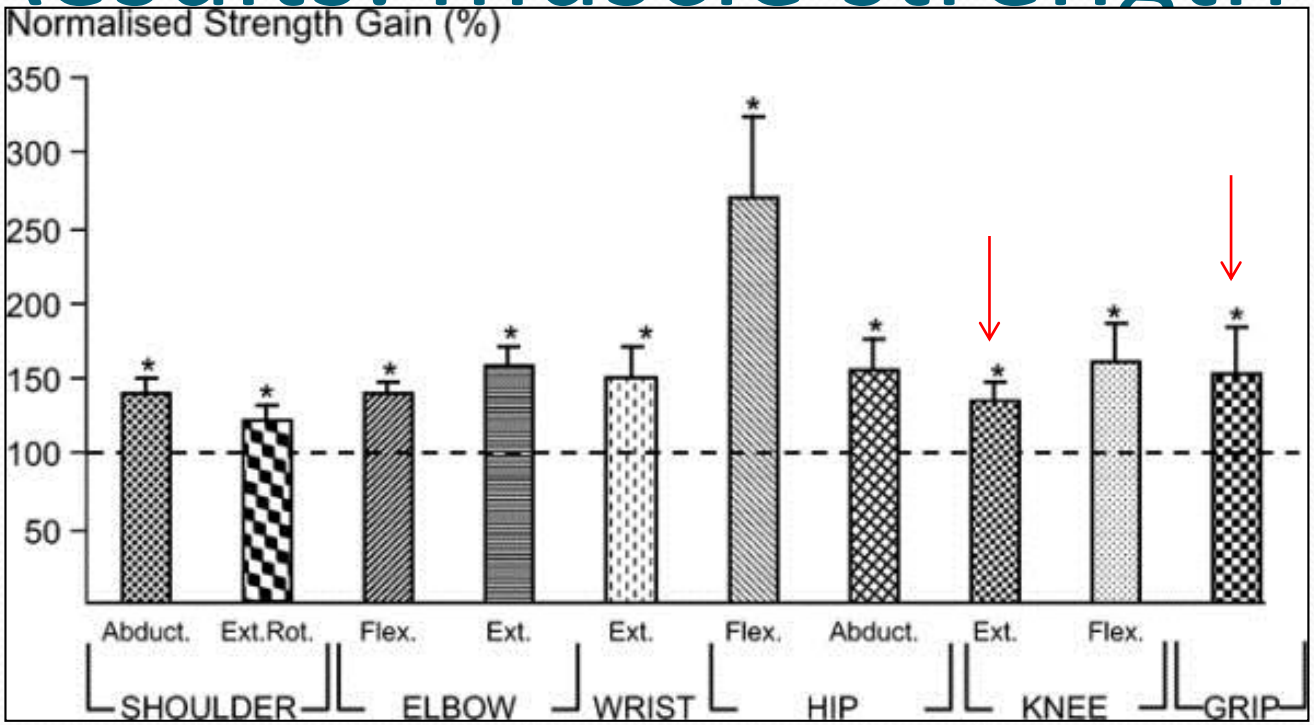
Exercised performed twice a day for 16 weeks

(Johnson et al. Muscle Nerve 2007;20:1242-48).

This program can improve

- Muscle strength
- Ability to stand up from sitting
- Walking ability

Results: muscle strength



Mean percentage change in patients (n = 7) muscle strength following the exercise intervention when compared to pre-intervention strength levels normalized to 100%. *P > 0.05

(Johnson et al. Muscle Nerve 2007;20:1242-48).

12-week submaximal resistance training under vascular occlusion: All adult myositis

- Air cuffs placed over inguinal fold and pressure of 70% of pulse elimination pressure
- Patients exercised 2 d/ week in a leg-press on 30% of 1 RM in 3 sets
  - Improved strength
  - Could lead to muscle hypertrophy
  - Safe: no increased CK

(Mattar MA et al Arthritis Res Ther 2014;16:473)

Health benefits from regular physical activity

- Strong association between aerobic capacity and health! Both in healthy and in myositis
- Regular physical activity and exercise can:
  - Improve quality of life
  - Reduce risk of type II diabetes, osteoporosis and cardiovascular disease
  - Reduce high blood pressure
- Important as individuals with inflammatory rheumatic diseases are at higher risk of developing cardio-vascular disease

Take home message

- Exercise should be designed individually and adapted to disease activity and disability with regular follow-up during active disease
- Active progressive exercise should be recommended to patients in all stages of disease – better to do something rather than nothing
- Exercise should be able to be incorporated in your daily life
- Regular physical activity

Thank you for listening!

Stockholm, Sweden