CrossFit® Balic Affiliate Gathering 2023

METHODS OF RECOVERY OF THE MUSCULOSKELETAL SYSTEM IN CROSSFIT TRAINING

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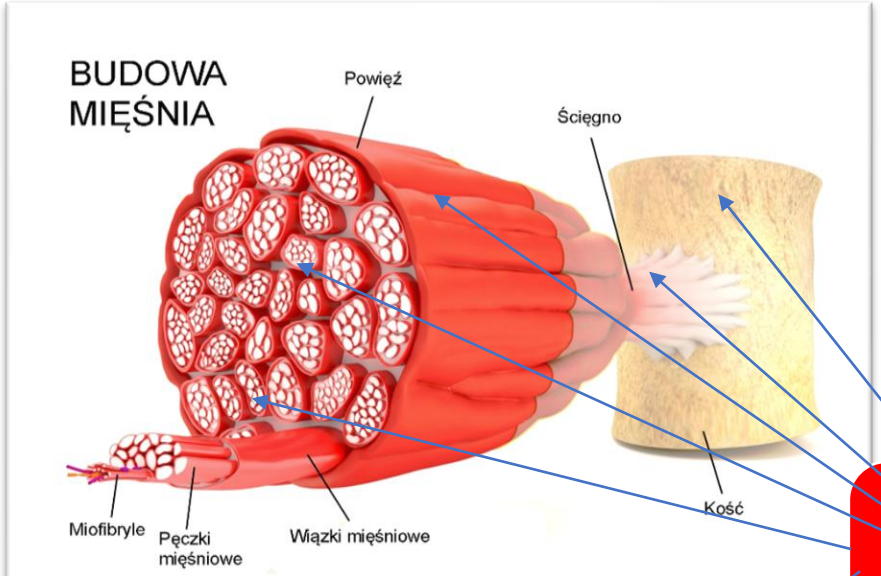
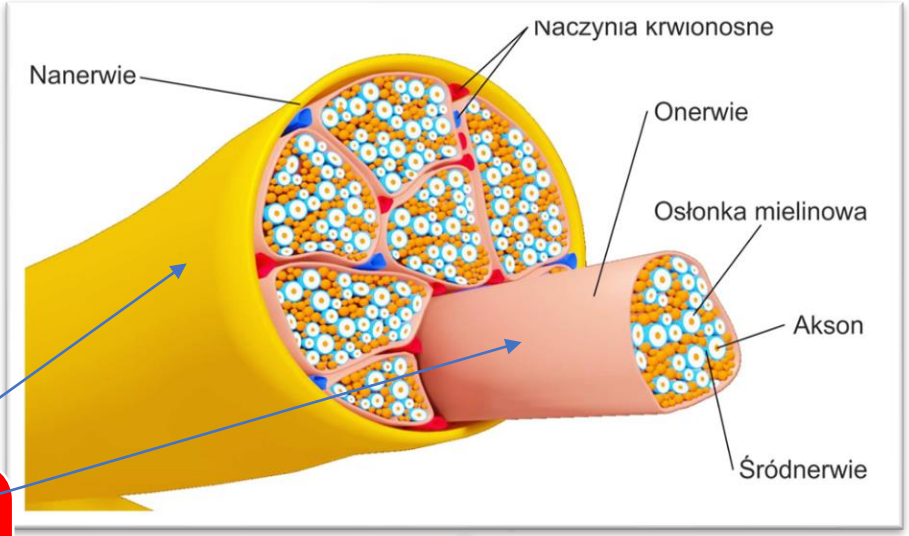
Recovery - Broad Process

- A return to a normal state **of health, mind** and **physical capacity (musculoskeletal system)**
- **Health** and **Mind** are recovery components that must be correct to expect a proper recovery process of the musculoskeletal system - The bass factor in CrossFit training [1]
  - **Health:** No chronic or medically regulated diseases, no transient diseases, normal state of all physiological and morphological parameters of blood components
  - **Mind:** Correct psychophysical state
  - CrossFit participants who had a covid-19 disease during the pandemic presented a significantly lower level of quality of life and CrossFit training [1]
- The process of returning to the normal state from the **musculoskeletal system** without structural damage
- The **musculoskeletal system** is mostly made of connective tissue of various types (fascia, tendons, joint capsules, ligaments, epinerium, perinerium and endonerium of peripheral nerves) and muscle tissue

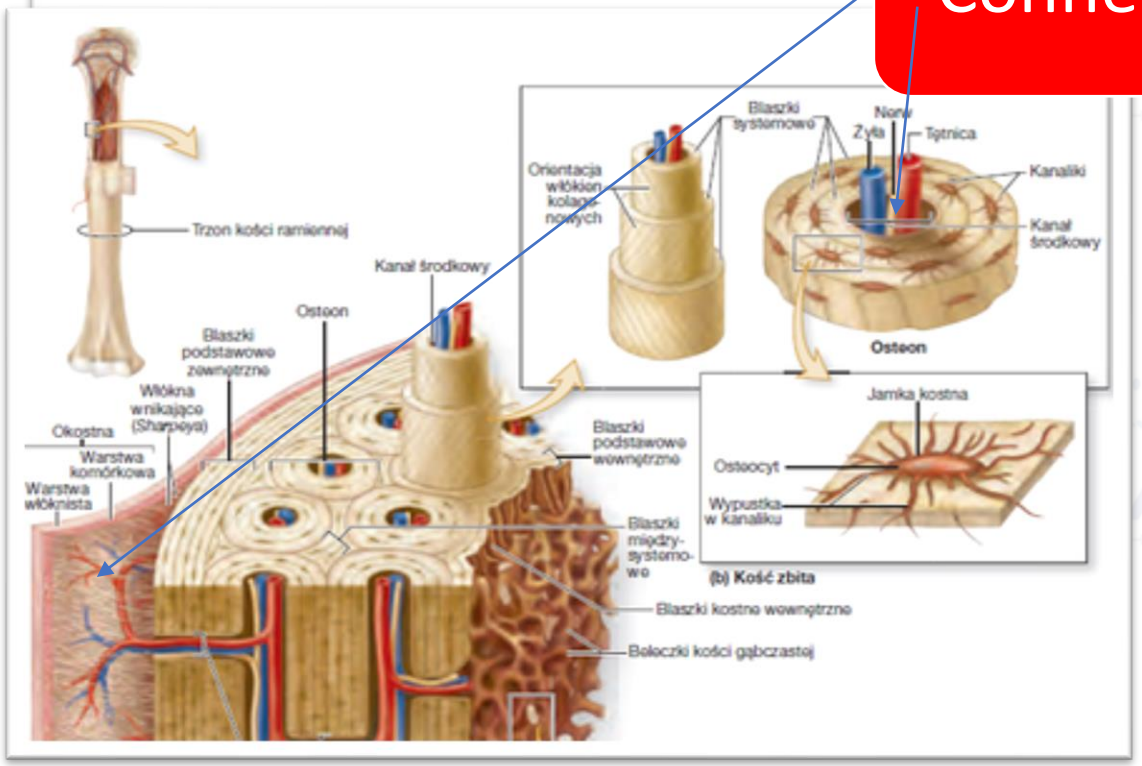
[1] Szajkowski, S.; Pasek, J.; Dwornik, M.; Cieślar, G. The Impact of Coronavirus Infection on Health-Related Quality of Life in Amateur CrossFit Athletes. Int. J. Environ. Res. Public Health 2022, 19, 16409. https://doi.org/10.3390/ ijerph192416409

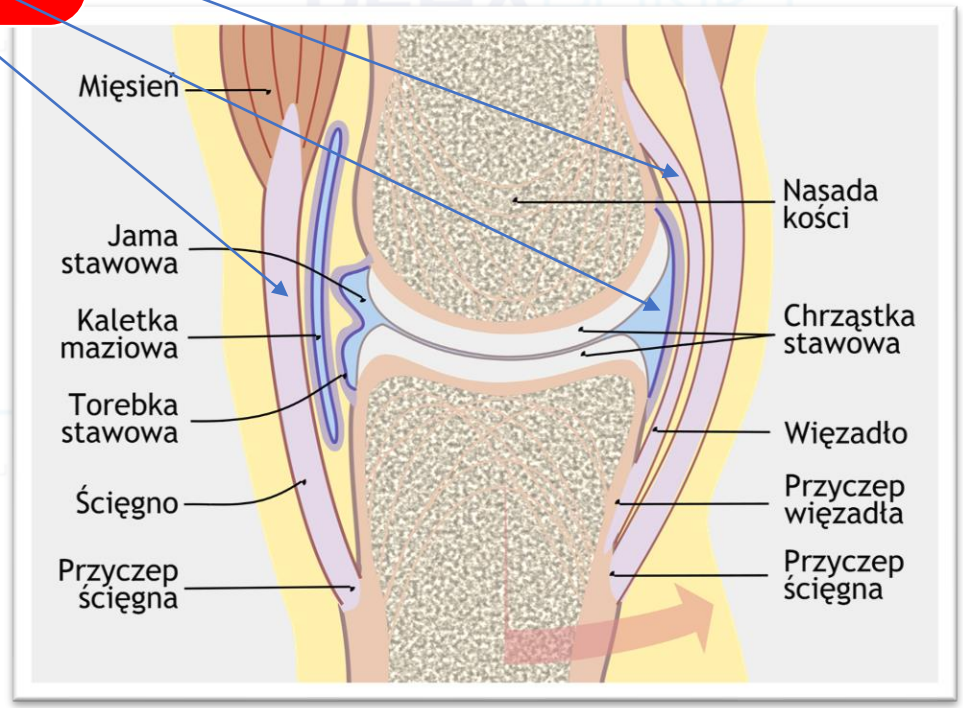
Musculoskeletal system





Connective tissue





The Effect Of Good Training - Correct Post-workout Reactions In The Connective Tissue

- Formation of post-training correct reactions
- Training without change is considered subliminal
- Removal of the correct post-training reactions determines the start of the next training unit
- Training on not regenerated correct post-workout reactions can lead to injury

What Are The Correct Post-workout Changes In The Musculoskeletal System

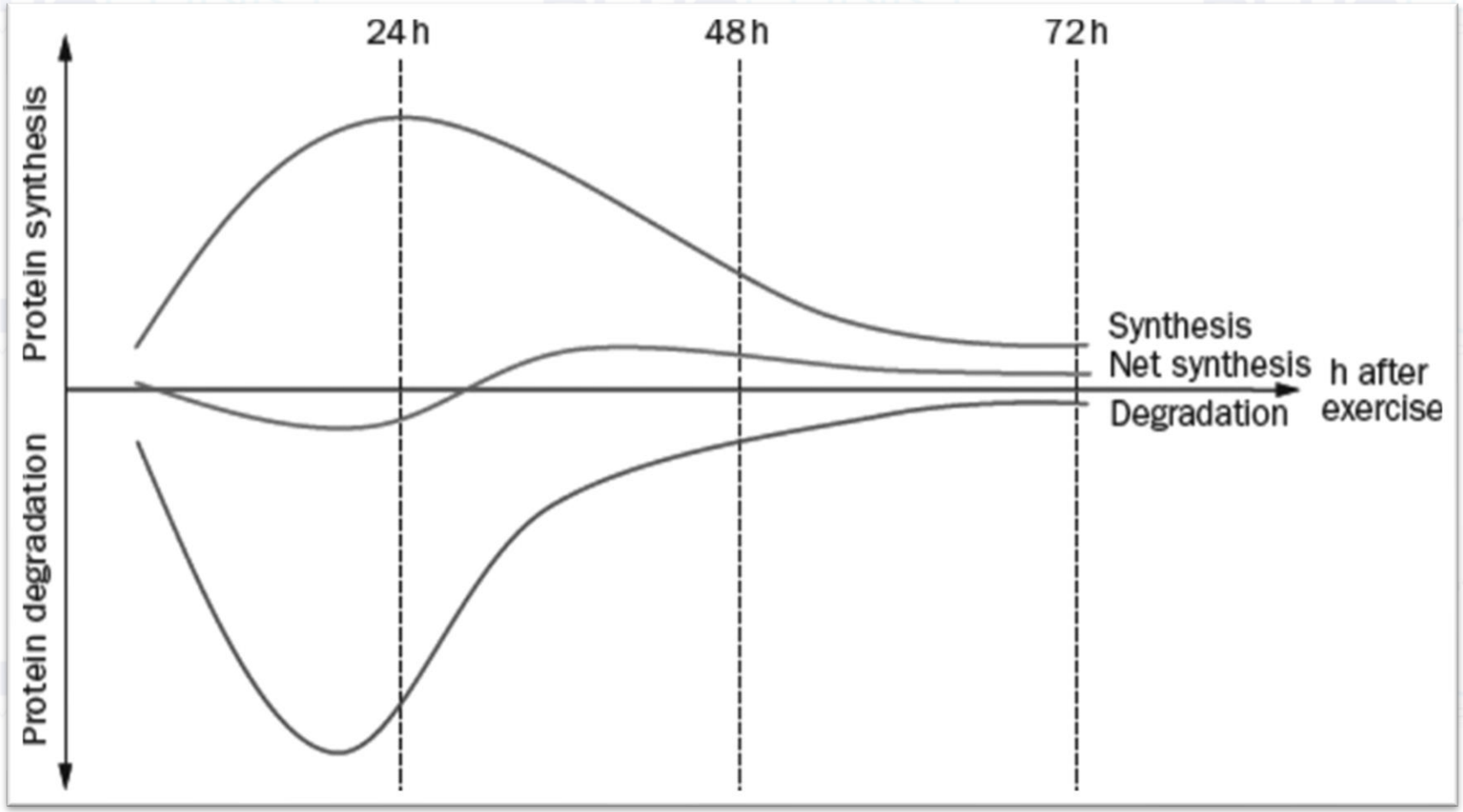
- **DOMS** (**D**elayed **O**nset **M**uscle **S**oreness) [1] - post-workout reactions in muscles
- **DOSS** (**D**elayed **O**nset **S**ofttissue **S**tiffness) [1] – post-workout reactions in fascia, tendons, ligament-capsular system
- Difficult outflow of venous blood → stasis → edema → reduction of arterial blood inflow
- Increase in the amount of interstitial fluid → increase in interstitial pressure → compression of capillary blood vessels
- Decrease nerve conduction (orthodromic and antidromic) → decrease chemical transmitters in synapses

- Carrying out the correct recovery process will result in tissue regeneration - reconstruction and consequently the structure and function will be better - **which is the main goal of training**

[1]. Jan Wilke[1,2], Michael BehringerIs "Delayed Onset Muscle Soreness" a False Friend? The Potential Implication of the Fascial Connective Tissue in Post-Exercise Discomfort. Int. J. Mol. Sci. 2021, 22, 9482.

Recovery Time Frame

Time diagram of correct post-training reactions vs pathological reactions - post-training overload [1]



[1]. Magnusson SP, Langberg H, Kjaer M. The pathogenesis of tendinopathy: balancing the response to loading. Nat Rev Rheumatol. 2010;6(5):262-268. Ackermann PW, Renström P. Tendinopathy in sport. Sports Health. 2012 May;4(3):193-201

Recovery Time Frame

RECOVERY IN DAYS

Too early
or too strong
training load

micro-injuries
82%

RECOVERY IN WEEKS/MONTHS

RECOVERY IN MONTHS

[1]. Jan Wilke, Michael Behringer Is "Delayed Onset Muscle Soreness" a False Friend? The Potential Implication of the Fascial Connective Tissue in Post-Exercise Discomfort. Int. J. Mol. Sci. 2021, 22, 9482

Different Ways Of Recovery
- The Variety Of Physical Effort In CrossFit

- Strength / Speed / Endurance / Power
- From maximum power - to strength endurance
- From top speed to speed endurance
- Additional features - dexterity / coordination / flexibility can also determine recovery

- The widest possible range of recovery methods

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training - Recovery Process - When We Apply?

- Only for the correct post-workout reactions at the correct time
- Only when we have correct other components in the general heath and mind
- The recovery process starts from the end of the workout until the start of the next workout

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

- **Lengthening or stretching** and when ? Muscles / Tendons / Ligaments / Joint Capsules / Nerves
- **Isometric Exercises** - the best effectiveness in preventing injuries? [1]
- **Rolling** - how it works? before or after stretching or lengthening?
- **Cold or Hot** recovery **-** with what and when?
- **Pressotherapy** e.g. Compression Recovery Boots
- **Electrotherapy** e.g. Compex Muscle Stimulators
- **Massage Guns** **-** when to use and when not to use?
- **Qualified Physiotherapy Treatments**

[1] Szajkowski, Sebastian, Michał Dwornik, Jarosław Pasek, and Grzegorz Cieślar. 2023. "Risk Factors for Injury in CrossFit®—A Retrospective Analysis" International Journal of Environmental Research and Public Health 20, no. 3: 2211. https://doi.org/10.3390/ijerph20032211

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

Lengthening or stretching - **what is the difference ?** Muscles / Tendons / Ligaments / Joint Capsules / Nerves

- **Stretching** is the process of preparing muscle and connective tissue for the possibility of reaching maximum length during training of dynamic movements or when obtaining maximum muscle strength
- **Lengthening** is a structural rebuilding process and should not be done during a warm-up or immediately after a training unit - it should be a separate training session
  - ✓ Lengthening allows you to maintain the correct biomechanics of the work of joints, antagonists and synergists muscles
  - ✓ Lengthening allows for the correct metabolic reaction of tissues - it removes the barrier of blood vessel compression

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

- Methodology of the **stretching** process (muscle, nerve, joint capsules and ligaments)

  - ✓ Dynamic rhythmic movements in full range of motion
  - ✓ Repetitive movements
  - ✓ Increasing the amplitude during exercise
  - ✓ Increasing speed while exercising

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

- Methodology of the **lengthening** process (muscle, nerve, joint capsules and ligaments)

  - ✓ tissue tension to MB (Motion Barrier) - the first slightest feeling of stretching or the first perceptible tissue resistance

  - ✓ Holding this position until the first slight stretching sensation disappears, then re-entering MB

  - ✓ We repeat this process until the feeling of stretching persists and does not disappear

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

- **Isometric Exercises -** the best effectiveness in preventing injuries?
  - ✓ CrossFit® affiliated clubs in Poland agreed to participate in the research. A total of 424 athletes (266 men and 158 women) training the CrossFit® participate in the research → Main Conclusions → Isometric exercises are the best factor protecting against injury in people training CrossFit® [1]
  - ✓ The greatest effectiveness in obtaining ischemia - the feeling of "burning" muscles
  - ✓ Isometric tensions without movement in the joints - safe in DOMS and DOSS pains
  - ✓ 2-3 times increase in blood supply
  - ✓ Increasing the metabolism and regeneration process
  - ✓ The best elasticity of connective tissues
  - ✓ It can be safely used in the recovery process and during warm-up

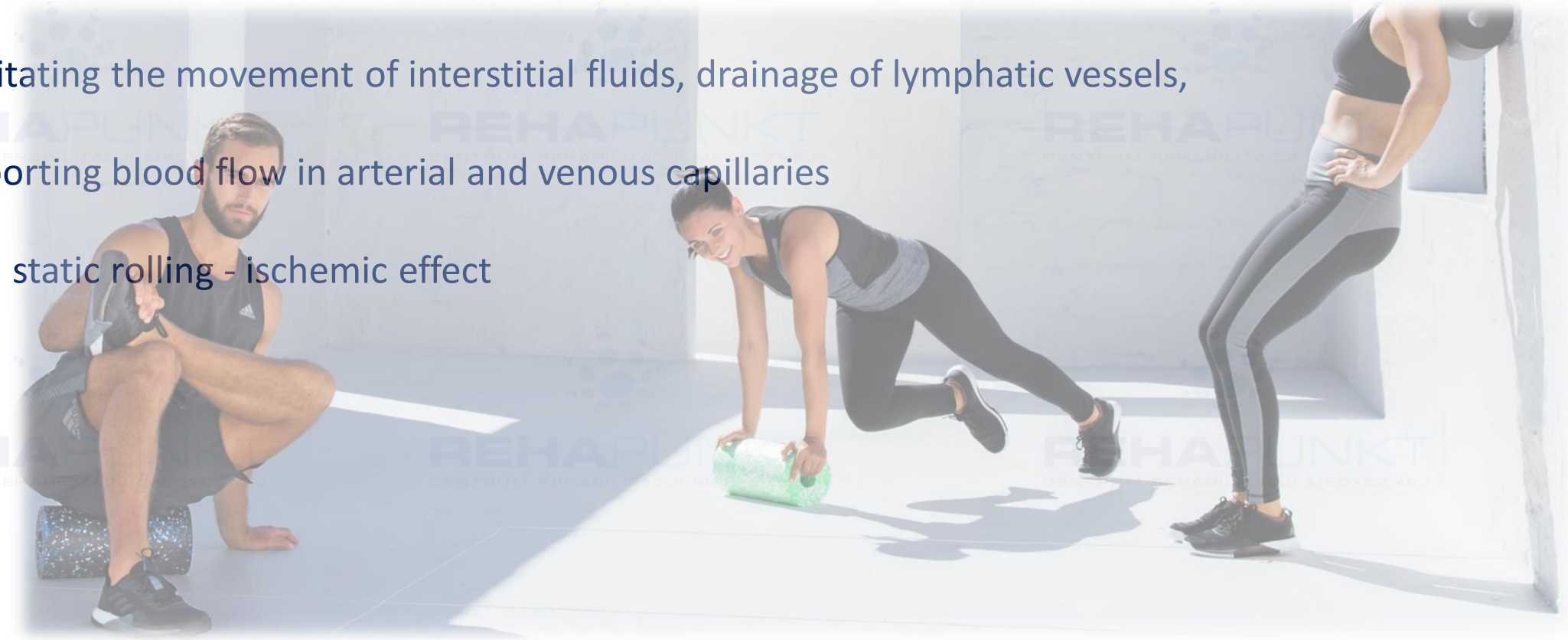
[1] Szajkowski, Sebastian, Michał Dwornik, Jarosław Pasek, and Grzegorz Cieślar. 2023. "Risk Factors for Injury in CrossFit®—A Retrospective Analysis" International Journal of Environmental Research and Public Health 20, no. 3: 2211. https://doi.org/10.3390/ijerph20032211 https://www.mdpi.com/1660-4601/20/3/2211/htm

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

Rolling - How does it work? Before or after stretching/lengthening? Implementation methodology?

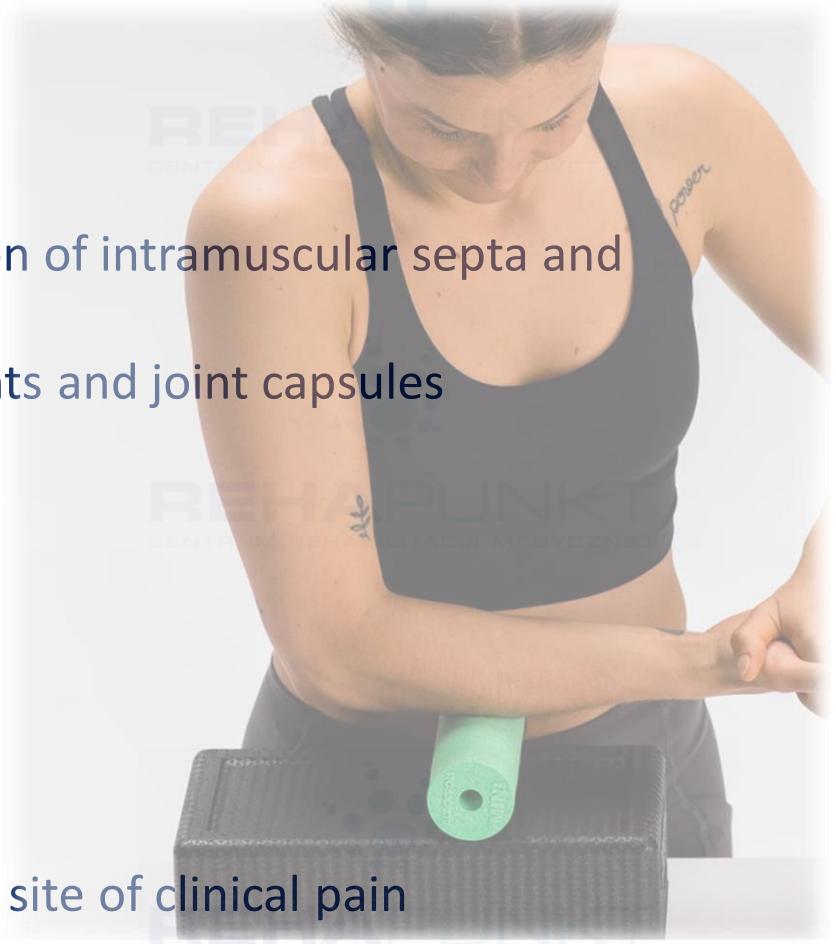
- Physiological mechanism

  - ✓ Shear compression force on tissues with no longitudinal direction
  - ✓ Facilitating the movement of interstitial fluids, drainage of lymphatic vessels, supporting blood flow in arterial and venous capillaries
  - ✓ With static rolling - ischemic effect



Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

- **Rolling** should always be after stretching / lengthening
  - ✓ Better physiological drainage effect after stretching / elongation of intramuscular septa and connective tissue of nerve trunks, connective tissue of ligaments and joint capsules
- Methodology of **Rolling**
  - ✓ Rolling without clinical pain
  - ✓ Rolling in places without structural trauma
  - ✓ The direction of rolling towards the site of structural damage / site of clinical pain
  - ✓ In the absence of the above, the direction of rolling is irrelevant distal and proximal



Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

Cold or hot recovery? physiological mechanism? What and When?

- **Cold recovery - temperature around 0°C - applied locally** (coldpack, ice cubes)
  - ✓ Deep penetration into the tissues
  - ✓ Reduction of muscle tone after 10 minutes of temperature stimulation
  - ✓ Reducing nerve conduction, reducing the excitability of ring-spiral endings in the muscles
  - ✓ Reduction of bleeding tendency as a result of long-term vasospasm 30-60 min (break 120 min and reapplication)
  - ✓ Pain reduction as a result of: inhibiting the release of pain mediators as a result of slowing down enzymatic processes, reducing nerve conduction, increasing the pain threshold

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training
Cold or hot recovery? physiological mechanism? What and When?

- **Cold recovery - temperature around 100°C do 180°C - applied locally (liquid nitrogen vapor)**

  - ✓ Fast cooling rate and shallow penetration into the tissues
  - ✓ Narrowing of blood vessels during the procedure and their rapid expansion 4 minutes after the end of the procedure (vessels up to four times wider than before the procedure) lasting up to 2 hours after the procedure
  - ✓ Pain reduction occurring 3-4 minutes after the procedure and lasting even 3-4 hours after the procedure
  - ✓ Inhibiting the release of pain mediators and increasing the pain threshold
  - ✓ Congestive effect 3-4 minutes after the end of the procedure causes better metabolism, eliminates accumulated metabolic products, improves circulation in the lymphatic vessels, which reduces swelling, but only in the case of persistent swelling 3-7 days after the injury
  - ✓ Reduction of pain in the mechanism of endorphin synthesis
  - ✓ Reduction of muscle tone after 1 minute of temperature stimulation
  - ✓ Increase in cell metabolism 3-4 minutes after the end of the procedure

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

Cold or hot recovery? physiological mechanism? What and When?

- **Cold recovery - temperature around 100°C do 180°C - applied globally (liquid nitrogen vapor)**
  - ✓ Cryostimulation - cold recovery applied with head
  - ✓ Increase inblood serum:
    - Adrenaline
    - Noradrenaline
    - Acetylcholines
    - Testosterone (men)
    - Hemoglobin
    - Leukocytes and platelets
    - Creatinine

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

Cold or hot recovery? physiological mechanism? What and When?

- **Hot recovery** - to the effect of **Skin Redness**
  - ✓ Local temperature above 38 °C until you feel maximum warmth
  - ✓ Increased blood supply
  - ✓ Improvement of tissue metabolism - increase in oxygenation
    - removal of unnecessary metabolic metabolites CO2, lactic acid
  - ✓ Increase in tissue metabolism - acceleration of collagen synthesis,
    increase in STGH (Soft Tissue Growth Hormone)
  - ✓ Never use during inflammation 3-7 days after injury

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

- **Presotherapy** of venous and arterial vessels
  - ✓ Unblocking the outflow of venous blood with post-workout unnecessary metabolites
  - ✓ Improving the inflow of arterial blood supporting regeneration
  - ✓ The process can cover all tissues of the upper and lower limbs
  - ✓ Very good intra-training effect - during competitions

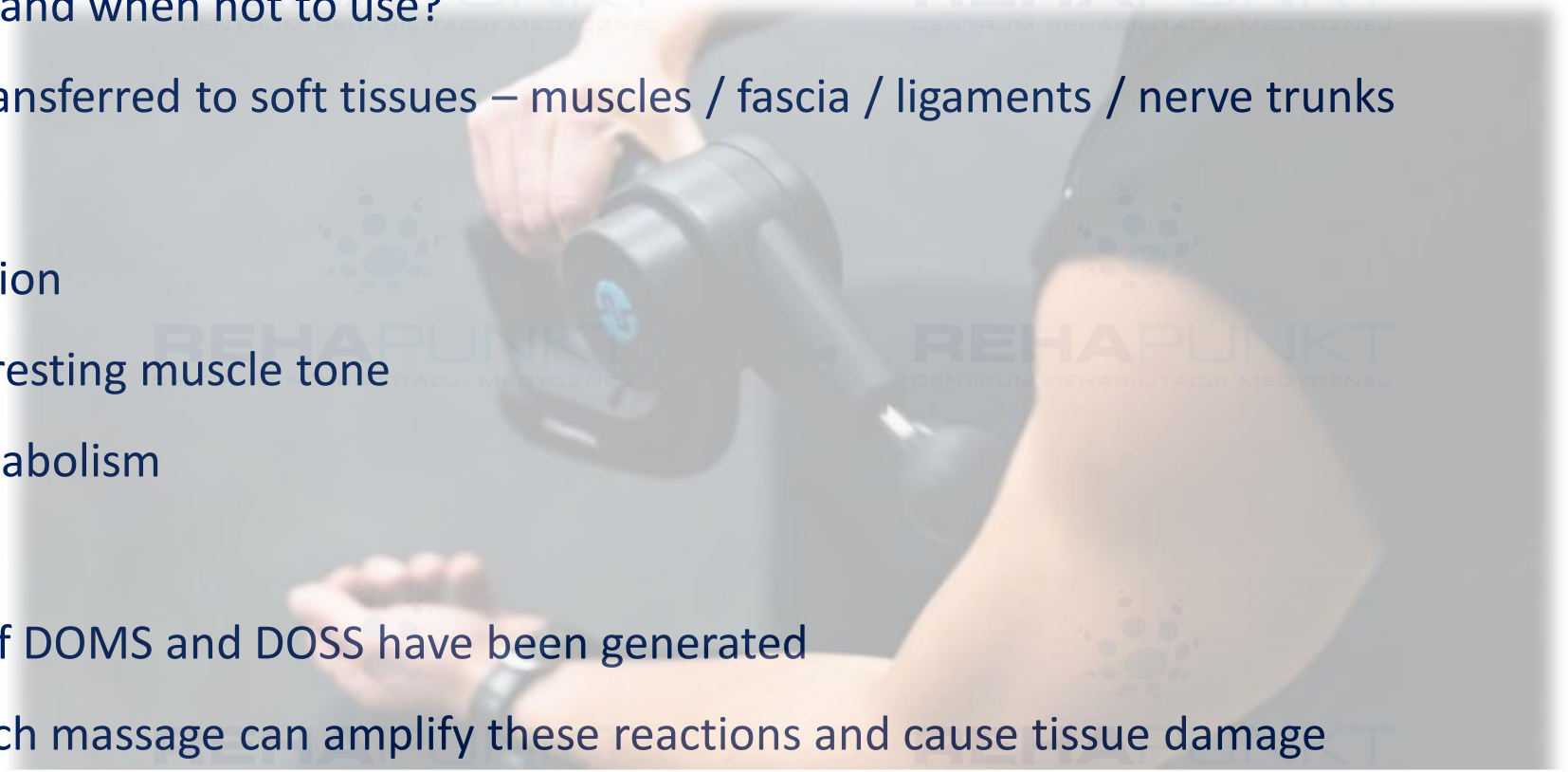
    between starts and around training

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

- **Electrotherapy** - low-frequency current - applied locally
- Low-frequency electrotherapy has been used for over 70 years
  - ✓ Improves blood circulation
  - ✓ Analgesic effect
  - ✓ Reduces resting muscle tension and accelerates regeneration
  - ✓ Very good intra-training effect

    - during competitions between starts and around training

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training



- **Massage Guns** - when to use and when not to use?
- Mechanical rhythmic force transferred to soft tissues – muscles / fascia / ligaments / nerve trunks
- Massage Guns:
  - ✓ Increases blood circulation
  - ✓ It reduces or increases resting muscle tone
  - ✓ Accelerates muscle metabolism
  - ✓ Contraindications !!!
    - If a large number of DOMS and DOSS have been generated during training, such massage can amplify these reactions and cause tissue damage
    - The condition of safety is to perform the massage without pain symptoms
    - Do not perform massage - Massage Gun immediately after training

Methods Of Recovery Of The Musculoskeletal System In CrossFit Training

Qualified physiotherapy treatments

NMT
Neuro-Muscular-Technique
Augmented soft tissue mobilization (ASTM) [1]

Transverse mobilization [2]

Inhibition [3]

Ischemic inhibition [4]

Physical therapy
- HIL laser
- Shock Wave
- Magnetic Field
- Presotherapy [5]

[1]. Imai K, Ikoma K, Chen Q, Zhao C, An KN, Gay RE. Biomechanical and histological effects of augmented soft tissue mobilization therapy on achilles tendinopathy in a rabbit model. J Manipulative Physiol Ther. 2015 Feb;38(2):112-8
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[5]. Li X, Zhang L, Gu S, Sun J, Qin Z, Yue J, Zhong Y, Ding N, Gao R. Comparative effectiveness of extracorporeal shock wave, ultrasound, low-level laser therapy, noninvasive interactive neurostimulation, and pulsed radiofrequency treatment for treating plantar fasciitis: A systematic review and network meta-analysis. Medicine (Baltimore). 2018 Oct;97(43):e12819.

Conclusion

1. The regeneration process occurs only in tissues with the correct post training reactions not damaged during training
2. The presented methods of recovery only support the regeneration that occurs spontaneously
3. The basic factor of regeneration is the time that can be shortened by recovery methods
4. Proper general health and mental health are the primary conditions in the process of regeneration using recovery methods

Thank you for your attention

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