Conditioning training of hockey juniors

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MD, MSc (Sport Science)
My Background

- Doctor of Medicine - Sports Doctor
- Bachelors degree in Sport Physiology, Biomechanics and Coaching
- Doctor / Physical conditioning trainer
  - Ice Hockey team Oulun Kärpät 2004 - 2008
    - 3 gold and 1 bronze
  - National Ice Hockey Team 2006 -
    - WC silver and bronze + Olympic bronze
  - Hockey Team Metallurg Magnitogorsk, Russia 2010 -
  - Individual players:
    - Niklas Bäckström, Kimmo Timonen, Tuomo Ruutu, Jussi Jokinen, Pekka Rinne, Niko Kapanen, Jarkko Immonen, Janne Pesonen, Lasse Kukkonen...
My Background

- Doctor / Physical conditioning trainer
  - Track and Field
    - 3 World Championship medalists
  - Cross Country Skiing
    - 4 World Champion and Olympic medalists
- Sport Nutrition Specialist and/or Consultant
  - McLaren Formula-1 team
    - Jenson Button and Lewis Hamilton
  - Red Bull Formula-1 driver Sebastian Vettel
Lecture topics

1) Important elements of junior condition training?
2) Basics of neuromuscular system
3) Biological maturation
4) Problems in western world among young athletes
5) Nervous system training in practise
**Important elements of junior condition training**

- The most important and difficult element is **the Nervous System**!
- Nervous system = Speed, skill, agility, balance...
  - 100m dash, long jump, high jump... WR:s haven’t improved significantly last 50 years
  - speed, skill, agility, balance improvement need
    - good brain - muscle coordination / motor skills
      - it comes out after thousands of correct repetitions specially in childhood
    - ability to activate fast muscle cells
      - if an athlete hasn’t activated fast muscle cells during childhood, it is more difficult to get good results later
- Ability to activate and relax proper muscles
  - some muscles are accelerating movements, some decelerating movements, some are supporting other muscles...
  - A COACH SHOULD KNOW THE MAIN MUSCLES OF MOVEMENTS AND EXERCISES !!!
Important elements of junior condition training

• Good core stability and muscle endurance
  – the most important part of the body is located around the center of gravity = MID BODY
  – today the muscle endurance and core stability is weak among young athletes in every sport

• Good cardiovascular condition and aerobic metabolism
  – they are the basis of all the other training
  – nowadays it is coming weaker and weaker
  – it needs minimum 45-60 min cardiovascular physical activity / day
  - it doesn’t need to be jogging or biking - it can be skill, agility, muscle endurance, functional training with short recovery breaks
Important elements of junior condition training

• Structural changes in cardiovascular-, metabolic-, neuromuscular… system
  – not only short time functional changes
  – usually one summer improvement is caused only by functional changes in tissues
    - more enzymes, better technique, more liquid in blood
    - not permanent changes
  – structural changes needs thousands of repetitions and long term planning
Brain and its structures
- control and information collecting center of everything in sport
- can be trained in whole life, but the best time is before growth spurt

Motor nerve
- conduct the impulse = order to muscles
- effectiveness can be improved

Sensory organs and nerves from muscles
- gives information all the time to the brain
- after long term training can be more sensitive = more effective

Muscle cells
- just repeat the orders
- fast and slow - which have been activated, will grow and improve
- metabolism (aerobic / anaerobic)
Basics of neuromuscular system

• Brain and its structures
  - give orders to motor functions (which it has learned)
  - control of movements (specific adaptation)
  - collect information (all correct and incorrect)
  - WE CAN IMPROVE BRAIN FUNCTIONS MUCH MORE THAN WE HAVE THOUGHT EARLIER
  - IT NEEDS THOUSANDS OF REPETITIONS UNDER DIFFERENT CONDITIONS

• Spinal cord
  - conduct the signals from brain to muscles and back
  - reflex center in very fast movements
    - some automatically learnt movements are already in the spinal cord level
  - WE CAN IMPROVE THE CONDUCTION VELOCITY IN SPINAL CORD LEVEL AND GET REFLEXES MORE EFFECTIVE BY USING FAST, NEW AND UNEXPECTED EXERCISES AND RHYTHMS
Basics of neuromuscular system

• Nerves from spinal cord to muscle and from muscle back to
  - conduct the nerve impulse to muscle and feedback from muscle
    - WE CAN IMPROVE THE CONDUCTION VELOCITY BY FAST, COORDINATION EXERCISES AND DOING DIFFERENT SPORTS DISCIPLINES

• Sensory organs inside the muscle cells
  - they can become more sensitive to movements, if we do different kind of sports = THEY ADAPT TO SAME MOVEMENTS QUITE EASILY, SO DONT KEEP DOING SAME EXCERSICE FOR A LONG TIME, CHANGE INTENSITY, RHYTHM, BODY POSITION....
Basics of neuromuscular system

- Muscle cells
  - “are just cells which are doing what they have been ordered to do”
  - big muscle cell can be slow if it has got slow impulses - small muscle cell can be fast if it has got fast movements
  - we can improve aerobic and alactic ( <15 sec ) metabolism easily with juniors, but lactic ( > 15 sec ) anaerobic metabolism is more difficult before growth spurt
    - concentrate e.g. 10x20m spurts before growth spurt and take 3x200m spurt after it
  - ALL PEOPLE HAVE ABOUT SAME NUMBER OF FAST AND SLOW MUSCLE CELLS AT BIRTH, BUT CELLS CAN ADAPT TO DIFFERENT WAYS DURING FIRST 8-10 YEARS OF LIFE
    - doing different sports and with different intensities, we can really activate all the muscle cell genes in our body
Basics of neuromuscular system

• IT IS POSSIBLE TO IMPROVE ALL LEVELS OF NEUROMUSCULAR SYSTEM, IF WE REMEMBER
  - to do different sports = before growth spurt track&field, football, basketball, wrestling, gymnastics...
  - to use different rhythms = not same rhythm adaptation in brain and reflex systems
  - to use different conditions and surfaces = outside, uphill, downhill, forest, swimming pool = brain, muscles, sensory organs... can adapt to different conditions
Basics of neuromuscular system

• IT IS POSSIBLE TO IMPROVE ALL LEVELS OF NEUROMUSCULAR SYSTEM, IF WE REMEMBER
  – To use various intensity = if you do always with 100%, you cannot control your muscles in slowly movements
    - jumps with 70, 80, 90, 100% intensity...
    - sprints with 70, 80, 90, 100% intensity...
  – To do thousands of repetitions = almost every day athletes should do nervous system training
  – 15-20 hrs of physical activity / week
  – > 15 min activity sessions
    - e.g. 15 min walk to school or practice and back = 30 min / day
Biological maturation

Age (calendar years)

Maturation %

0%

50%

100%

Nervous system

Locomotory system

Internal organs

Hormones

Scammon 1930
Biological maturation of nervous system

- Nervous system grows very quickly during first 10 years of life
  - during that period is the most effective time for nervous system training = SPEED, COORDINATION AND AGILITY EVERY DAY
  - DONT CONCENTRATE TOO EARLY ON ONLY ONE SPORT
  - HOW IS IT IN YOUR CLUB OR COUNTRY ??

- Before and during growth spurt comes period when bones are growing very quickly which can cause motor control disturbances / problems
  - TRY TO MOTIVATE YOUR ATHLETES TO CONTINUE SPEED AND AGILITY TRAINING DURING THIS PERIOD
  - START TRAINING WITH FAMILIAR TRAININGS AND STEP BY STEP TRY TO DO MORE COMPLICATED EXERCISES - EXPLAIN THIS TO THE ATHLETE
Biological maturation of nervous system

- DURING THE GROWTH SPURRT PERIOD IT IS VERY IMPORTANT TO EXPLAIN TO THE ATHLETE, THAT NOW IT IS TIME FOR MAINTAIN YOUR SKILLS AND AFTER GROWTH SPURRT HE/SHE CAN IMPROVE THEM AGAIN
  - highest drop out is in this age
  - are we selecting wrong types to ice hockey
- Growth spurt and motor control problems can occur in different calendar ages, because of different timing of biological maturation
  - DIFFERENCE CAN BE EVEN 3-4 YEARS, BUT TYPICALLY IT IS 2 YEARS
  - HOW IS YOUR TALENT SELECTION SYSTEM?
    - DO YOU ONLY SELECT TALL, STRONG PLAYERS OR DO YOU SELECT ALSO BIOLOGICALLY LATE MATURATED PLAYERS, WHO CAN HAVE EVEN BETTER SKILL POTENTIAL?
Problems in western world among young athletes

- Basic motor control is not good enough / or too simply improved
- Basic endurance is not good enough = cannot repeat speed and agility exercises
- Core stability is not good enough = more injuries and balance is poor
- What is the reason?
  - Children don’t have physical activity outside of the school or sport training
  - Time of individual Sport activity is less than 20-30 years ago
- In Finland we did study for 2800 sport juniors
  - training diary
  - training time / week
  - speed and skill and technique training time / week...
Some results of Junior Athletes Study in Finland 2008

- Total physical activity decreases from ages 8-11 to over 12 years old juniors
- Physical activity in main sport increases in older groups
- Physical activity *not in sport training (leisure time or individual training)* decreases very dramatically after 11 years
- Skill (*basic motor skills*) training decreases in older groups
  - older than 12 yrs old juniors do mainly their “main sport”
- Technique (*sport specific*) training increases in older groups
- Junior athletes don’t do speed or agility training alone as much as expected
  - almost always it needs own coach
## Physical activity / week / In Finland

### Physical activity Hours / week

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-11v</td>
<td>10.1</td>
<td>6.9</td>
<td>3.5</td>
</tr>
<tr>
<td>12-15v</td>
<td>8.7</td>
<td>6.5</td>
<td>4.2</td>
</tr>
<tr>
<td>16-18v</td>
<td>2.8</td>
<td>4.4</td>
<td>5.2</td>
</tr>
</tbody>
</table>

**MUUT LIKUNTATUNNIT - keskiarvo**

- Boys: 10.1
- Girls: 6.9
- Total: 3.5

**PAÄLÄJIN OMATOIMISET HARJOITUSTUNNIT - keskiarvo**

- Boys: 8.7
- Girls: 6.5
- Total: 4.2

**OHJATUT HARJOITUSTUNNIT - keskiarvo**

- Boys: 2.8
- Girls: 4.4
- Total: 5.2

**KESKIARVO**

- Boys: 2.6
- Girls: 2.0
- Total: 3.1
Sport coaching 20 years ago

Endurance

Basic skills

Muscle strength

Sport training

Basic skills

Strength

Endurance
Sport coaching today

- Endurance
- Basic skills
- Strength

Sport training

- Basic skills
- Endurance
- Strength
What to do?

• Education / knowledge for juniors, parents, PE-teachers and coaches

• Home tasks for juniors (muscle endurance, aerobic training, speed, motor skills, agility, core stability)

• Athletes have to come by walk or bike to training - get easily aerobic basic trainability

• Longer training sessions - warm ups and cool downs, which can be speed and agility or other type of nervous system training
  - warm up doesn’t need to be running or bike - it can be muscle coordinations, agility, core stability = 10-15 min
  - cool down doesn’t need to be running or bike - it can be muscle coordinations, agility, core stability = 10-15 min
Junior training = NERVOUS SYSTEM, MUSCLE ENDURANCE AND CARDIOVASCULAR TRAINING

- New stimulus
  - faster, better, longer, more power...
  - competitions
  - motivation

- In speed training not long sets
  - 2 - 15 seconds / set
  - AVOID NERVOUS SYSTEM FATIGUE AND HIGH ACCUMULATION OF LACTIC ACID BEFORE GROWTH SPURT, BUT AFTER THAT YOU DON’T NEED TO DO IT

- As much repetitions as possible to get structural adaptation of nervous system
  - how much is enough = ATHLETES CAN CONCENTRATE TO THE SAME EXERCISE
  - WHEN YOU SEE, THAT YOUR ATHLETES ARE TIRED, YOU CAN CHANGE EXERCISE, BUT ANYWAY CONTINUE THE TRAINING
Junior training = NERVOUS SYSTEM, MUSCLE ENDURANCE AND CARDIOVASCULAR TRAINING

• Every day
  – warm up > 15 min
  – before ice practice
  – cool down > 15 min
  – in separate of ice training sessions

• If you want to effectively improve neuromuscular system
  – 15-20 hours / week physical activity
    - collecting from short sessions and home tasks
  – nervous system training
    - after easy / rest day
    - in the beginning of the training

• IN SPEED EXERCISES RECOVERY TIMES ARE IMPORTANT
  – BEFORE GROWTH SPURT 20-40 SEC
  – AFTER GROWTH SPURT 2-3 MIN
Examples

- **Speed + jumps**
  - warm up coordination’s 15 min
    - knees up + upper body totally relaxed 3x20m (forward, backward, sideward)
    - knees up + same arm / same leg 3x20m (forward, backward, sideward)
    - left knee up + right heel up 3x20m (forward, backward, sideward)
    - left heel up + right knee up + arms are rotating opposite directions 3x 20m (forward, backward, sideward)
  - sprints over sticks or speed ladder with high frequency or rhythm:
    - 6x20 sticks or speed ladder as fast you can (take different ways - first right leg, then left, left-right-left-right.. /1 min recovery
    - 3x30m sprint forward / 90-95% intensity / walk back / 3 min recovery after series
    - 3x30m sprint backward / 90-95% intensity / walk back / 3 min recovery after series
    - 3x30m sprint right side ahead / 90-95% intensity / walk back / 3 min recovery after series
    - 3x30m sprint left side ahead / 90-95% intensity / walk back / 3 min recovery after series
  - jumps uphill:
    - left–right-left-right 5x40m / walk back
    - skating jumps forward 5x40m / walk back
    - skating jumps backwards 5x40m / walk back
  - aerobic cycling or jogging 10 min + muscle endurance by functional training 15 min
Example

• **Speed endurance + jumps**
  
  - warm up coordination’s 15 min
  - basketball 15 min
  - core stability 10 min
  - sprints in stairs:
    - 4x8-10x30 steps sprint for every step / walk down / 3 min recovery between recovery
  - easy jumps - intensity 75-80%:
    - left-right-left-right 5x60m / walk back / 3 min recovery
    - skating-jumps forward 5x60m / walk back / 3 min recovery
    - skating-jumps backward 5x60m / walk back / 3 min recovery
  - football or basketball 30 min
Example week

- **Mon**  Coordin/Agility + Ice + Core stability + at home aerobic endurance
- **Tue**   Speed (off ice) + at home core stability
- **Wed**   Coordin + Ice + Jumps + at home aerobic endurance
- **Thu**   Individual Speed on Stairs
- **Fri**   Coordin/Agility + Ice + Core stability
- **Sat**   Individual speed endurance + jumps + balance
- **Sun**   Rest
Thank you!