Back Health and Performance in Alpine Skiers

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Topics - Low Back Pain (LBP) and Prevention

- Balancing the evidence – experience vs scientific inquiry.
- Back injury prevalence in alpine skiers
- Types of injury, causes of pain
- Low back disorders
- Preventative measures
- High(er) risk training activities.
- Back healthy best practises
- Core training methods and principles
- Assessing your athletes.
Evidence-based training decisions

• Research findings can inform our training decisions (evidence-based approach).

• Research has its own set of problems (biased; flawed methodology; sample composition not relevant; sample size too small)

• Skiing is a very diverse activity in a very unpredictable environment.

• Research is spare with elite level and virtually non-existent at development level.
• Data collected measuring rate of injuries before (2006-2012) and after (2012-2015) the introduction of 35m and 30m skis.
• Over nine seasons, 2402 athlete interviews conducted.
• No reduction in the rate of ACL injuries with new skis.
• Did not collect data pertaining to overuse type injuries.
Back injury prevalence in alpine skiers

- Back injuries are generally not sustained from a single traumatic event.
- Are the result of chronic exposure to overload.
- The back (not knee) is reported as the most affected body part where overuse injury is concerned.
- Prevalence in the normal population is ~15%.

### Table 1: Numbers and prevalences of overuse problems in World Cup slalom skiers.

<table>
<thead>
<tr>
<th>Women Location</th>
<th>Numbers</th>
<th>Prevalence [%]</th>
<th>Men Location</th>
<th>Numbers</th>
<th>Prevalence [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Back</td>
<td>7/17</td>
<td>41.2</td>
<td>Low Back</td>
<td>5/15</td>
<td>33.3</td>
</tr>
<tr>
<td>Knee</td>
<td>5/17</td>
<td>29.4</td>
<td>Knee</td>
<td>2/15</td>
<td>13.3</td>
</tr>
<tr>
<td>Hip</td>
<td>3/17</td>
<td>17.6</td>
<td>Hip</td>
<td>2/15</td>
<td>13.3</td>
</tr>
<tr>
<td>Tibia</td>
<td>2/17</td>
<td>11.8</td>
<td>Tibia</td>
<td>1/15</td>
<td>6.7</td>
</tr>
</tbody>
</table>

Types of low back injury

• Fractures – vertebra or pars interarticularis
• Disk irritation / herniation / degeneration
• Ligament strains
• Muscular strains
• Sciatic nerve pain.
• SI joint
• Low back disorder
Conditions/diseases affecting the low back

- Lumbar Scheuerman’s disease
- Spondylothesis
- Spondylosis
- Presence of a 6th lumbar vertebra
- Ankylosing spondylitis

- Warning signs of a low back condition in athletes and when to seek assessment.
- More serious symptoms.
Possible causes of low back pain

**General population**
- Inactivity (e.g. sitting for long periods)
- Spinal instability
- Muscular imbalances
- Structural abnormalities (e.g. Scheuermann’s)
- Altered motor control.
- Postural issues (e.g. anterior rotated pelvis)

**Alpine skiers**
- Biomechanical issues (skiing and dryland)
- Mechanical overload of weak links.
- Insufficient recovery
- Excessive forward/backwards bending, side bending in a preloaded spine resulting in high spinal disc loading.
- Insufficient / improper warm up
Specifically in ski racers......

- frontal bending, lateral bending, and torsion in the loaded spine
- Peak torque values of up to 3 times body weight
- “unforeseeable external perturbations might force athletes to even larger amplitudes of spinal motion than our controlled measurement situations”


Anecdotally – rate of overuse back injuries seem to increase in congruence with an increase in training volumes and intensities.
Inappropriate volumes / lack of recovery leading to excess back fatigue?
Preventative measures

• Reductions in forward and lateral bending (biomechanics)
• Well-progressed core/hip stability training program
• Increased back endurance; increase hip strength/power
• Well-planned ‘unloading’ phases of training
• Warm ups (blood flow, core/hip activation.)
• Minimizing higher risk activities and / or doing these when not fatigued.
Higher risk training practices

• Poor warm up
• Technical breakdown
• Excessive external loading
• Lack of variation.
• Exercises resulting in spinal flexion, esp. under load.
• Poorly progressed plyos.
• Biking?? (high volumes of bike training, bike position and fit, lack of mobility work after etc.)
Core myths and controversies

• Stretching is effective to treat sore backs.
• Power comes from the core
• Tight hamstrings cause back pain
• You need to isolate TA and Multifidus to overcome back pain.
The impact of sitting

• Prolonged periods of sitting (poorly) result in:
  • Compression of lumbar disks
  • Tight hip flexors
  • Gluteal dysfunction
  • Postural changes

• “many troubled backs are flexion intolerant and are exacerbated by slouched sitting, which eventually exceeds the endurance capacity of the hip flexors and the back extensors” McGill (2014)
Back healthy best practises for dryland training

• Globally assess all factors which can affect back health – dryland, skiing, travel, rest.
• Design a specific warm up which prepares the back for intense activity
• Choose exercises that promote spinal stability (limit movement in the back esp. under load)
  • **Develop strong hips**
  • Ensure the stress does not exceed tolerance (e.g. exercise technique) – monitoring and supervision.
  • Reduce peak spine compressive loads to reduce the risk of end-plate fracture (e.g. front squat as opposed to back squats; periodization)
  • Reducing repeated spine motion to full flexion to avoid risk of disc herniation (e.g sit ups)
• Reduce time spent sitting
• Reduce cyclical twisting motions under load

From McGill (2014) *Ultimate Back Fitness and Performance*
Rehab exercises for sore backs

**Avoid**
- Inactivity
- Toe touches, esp. in the morning (do ‘cat-camel’ instead)
- ‘Pain generators’
- Stretching of low back
- Mobility exercises for the back
- Overload training
- Sitting for long periods esp. IF it exacerbates symptoms

**Safe exercises (generally speaking)**
- Rolling exercises - hips
- Stretching hips – hips
- Exercises which promote spinal stability.
- Gluteal exercises.
- Cat-Camel
- Lunge / stepping patterns
- Bird dog
- Dead bugs
- Side planks
- ‘micro-dosing’
Demands of alpine skiing

• The skier is constantly working to maintain ‘balance’
• Forces will push the athlete backwards, inside and/or across the skis if they fail to counteract these forces.
• Resist unintended flexion, extension and counteract rotational forces.
• Transfer of high levels of energy/torsion repetitively from one turn to the next.
• Surface is very unpredictable – skiers are constantly knocked off balance. Torso strength is critical to maintain balance.
Training Methods

Body weight progressions
Unstable surfaces
Weightlifting?
Cable pulls
Carries
Medicine ball throws
Suspension training
Training principles

• Have a basic knowledge of anatomy and design balanced core training programs.
• Progress from basic to advanced.
• Show competency with body weight before moving to weights.
• Use different training methods (variation)
• Balance training IS core training and is very important for skiers!
• Include anti-flexion, anti-extension and anti-rotational exercises.
• Supervizing your athletes – technique is crucial to avoiding injury
What’s the problem with sit ups?

• Generate very high compressive forces to the lumbar spine.
• Repeated spine flexion exercises resulted in disc herniation in controlled lab experiments (McGill, 2015)
• Research has led Canadian and US Military to remove sit-up tests from their protocols.
• Is not relevant to movement in sport or daily living.
• Note that some backs are more flexion tolerant than others.
Advanced core training??
Training the Hips

• Much back pain / dysfunction comes from poor hip motor control and strength.
• The best athletes have strong, stable hips which can produce powerful movements.
• Gluteal amnesia
• Progress training from basic to advanced – ensure movement quality at each step before introducing next challenge.
• Maintain stable spine throughout.
• Lunging, stepping, deadlifting, squatting, supine bridging patterns, carrying.
Front squat vs Back squats?

A loaded squat should not go deeper than the point where lumbar flexion occurs.
What about balance training?
Assessments to assess core/hip stability & motor control:

**Motor control tests:**
- Single leg hop (stick landing)
- SL drop (30cm box)
- Landing error scoring system
- SL squat
- Hurdle step (FMS) or travelling lunge
- Overhead squat (FMS)
- Stability push up (FMS)
- Rotary stability (FMS)

**Strength/Power tests:**
- Sorensen test (back and hip extensor strength-endurance)
- Planking (side/front)
- SL vert jump
Resources:

www.youtube.com/user/mrlambo76