

Preparation for skiing and snowboarding

BACKGROUND Winter sports participation is growing in popularity following the success of recent Australian Winter Olympic Teams. On the recreational front, snowboarding is equal in popularity to skiing. Injury types are varied and specific to the sports.

OBJECTIVE This article compares the common injuries sustained while skiing and snowboarding and details key factors that are assessed with our national mogul and snowboard teams.

DISCUSSION Before being able to provide advice regarding fitness and training as a preventive approach to reducing injuries, it is important to understand energy systems of winter sports. Suitable training regimens are considered and other preventive considerations, such as skill level, ski conditions and equipment are discussed with particular attention to specific energy system tests that can identify weakness.

Skiers and snowboarders now share the winter slopes in equal numbers. The differences in mechanics between skiing and snowboarding account for varied incidence levels of injuries between the sports, although hard data is difficult to obtain because of the 'bypass effect' (in which skiers leave the mountain without reporting their injury).

Downhill skiing and snowboarding are both exhilarating activities with quite different potentials for injury. Internally reported figures from Australian ski resorts demonstrate a higher incidence of upper limb injuries in snowboarders as compared to skiers, who tend to injure their knees. In the snow sports community, there is also growing concern about the number of head or spinal injuries occurring in snowboarding. Key factors in the prevention of ski and snowboarding injuries include:

- better training
- proper pre-season preparation
- on-snow warm up, and
- remaining within the limits of competence.

Many skiers and snowboarders enjoy exploring the back country and off-piste slopes. Negotiating natural obstacles including rocks, logs, trees, cliffs and bumps increases the chance of injury. Flat

light, heavy snow, powder, ice and 'crud' snow also lead to injury.

Risk factors

Equipment failure

Ski binding malfunction all too commonly contributes to injury. A key factor is the binding setting, which is set too high and releases too late to avoid injury in many cases. Antifriction devices are often damaged and remain unserviced from season to season.

Number of skiers/boarders on the slopes

Improved lift technology has resulted in more skiers on the slope. Collisions commonly result in some serious injuries.

Testing skiers and snowboarders

In order to prevent injury, a preventive approach can be taken in the pre-season assessment of both elite athletes and 'weekend warriors'.

The Olympic Winter Institute of Australia (OWIA), in conjunction with the Physiology and Biomechanics Department at the Australian Institute of Sport (AIS), has developed a test battery for elite mogul skiers and half pipe snow-

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Figure 1. VO2 max test



Figure 2. Skin fold test



Figure 3. Wingate peak test

boarders over the past year. The tests are very useful in illustrating the energy systems required to perform well, particularly if there is an intentional action plan to reduce injuries by improving fitness. The OWIA is also using the results as a key basis for the selection and funding of participants in the elite program.

The enthusiast skier or boarder can learn from a biomechanical breakdown of the sports, while general practitioners can provide more specific and accurate information to the skier/boarder who requests advice on pre-season conditioning or injury rehabilitation.

Screening tests and fitness

VO2 max

VO2 max (Figure 1) is used to assess aerobic capacity. Mogul coaching staff and physiologists

believe that an athlete with high VO2 max capacity will be capable of training well on the hill all season without demonstrating errors in technique and intensity toward the end of ski runs. Scores of 50 and 60 mL/kg/min for VO2 max for women and men respectively are appropriate as minimal standards at the elite level.

Skin folds

The sum of seven skin folds (Figure 2) measured using correct anthropometric technique can be a measure of general fitness. Obviously, higher power to weight ratio will increase performance whether it be for the elite skier or the 'weekend warrior'. Issues such as diet and exercise are important. Totals of seven skin folds in the order of 55 mm for men and 75 mm for women are considered appropriate at the elite level.

Wingate peak

Wingate peak (Figure 3) and 30 second average is an all out power test on a bike, which is analysed with a bike computer. Elite men and women score a peak of 16.5 (w/kg) and 13.5 (w/kg) respectively. The implication to a 'weekend warrior' who is attempting to improve performance and lessen injury is that intensity work is required above steady state aerobic training.

Vertical jump

The vertical jump (Figure 4) tests muscle power and coordination with an objective method. It is a simple field test that can be applied at home. Elite men and women jump 62 cm and 52 cm respectively.

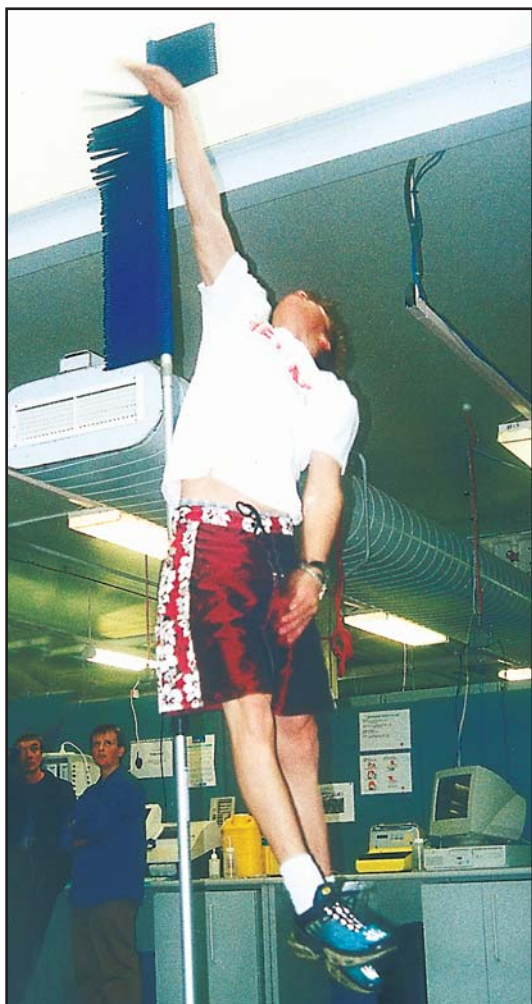


Figure 4. Vertical jump test

One legged press

The one legged press (Figure 5) is three successive 90° bends used to assess leg strength. Minimum standard for men and women in elite moguls is currently 2.2 x body weight and 2.0 x body weight respectively. This can be easily administered at a local gymnasium and can be performed by enthusiasts. It is useful in identifying discrepancies in strength between the left and right leg. More than a 10% difference is considered a problem that requires rectification.

Cybox testing

Cybox testing (Figure 6) is a specialist test conducted by physiotherapists who have access to a Cybox. Muscle imbalances between hamstrings and quadriceps can be identified. A suitable quadriceps-hamstring ratio is 4:3, while the OWIA coaches place even more emphasis on the hamstrings and recommend no greater than 10%



Figure 5. One legged press



Figure 6. Cybox test

deficit of hamstrings. The implication is that hamstring function is extremely important for effective knee function.

Dips

The maximum number of dips to 90° are recorded to assess upper body strength. Recreational skiers/boarders require upper body strength for poling, pressing up after falls and for initiating some boarding manoeuvres including spins.

Box jumps

Figure 7 demonstrates the specificity of box jumping to skiing. A 40 cm high box can be used to detect agility and anaerobic fitness. Elite mogul



Figure 7. Box jumps



Figure 8. Core strength test

skiers can perform 45 and 35 jumps for men and women respectively. This test can be adapted to be included as part of a fitness program.

Core strength

Back injuries appear to be very common in skiing and boarding, with published literature often underestimating their incidence rate. Testing of core strength (Figure 8) should emphasise postural control and function rather than pure power. Cross training with Swiss balls, medicine balls and Pilates can be examples of suitable programs. Core control is vital for both performance and injury protection.

Table 1 highlights exercises to include in a home fitness regimen. For specificity and structure consult with a sports physiotherapist, sports physiologist or general practitioner with an interest in winter sports.

Conclusion

The Australian Physiotherapy Association introduced a 'Get fit to ski' program in 1987. Physiotherapists who use this program oversee a 24 exercise circuit that runs for eight weeks before the ski season commences. The circuit includes ski specific exercises including quadriceps drills, balance work, aerobic slalom runs, box jumps, upper body coordination, and stretching. Although this program may be more than the average weekend skier seeks, it may prevent a rescue by the ski patrol.

Acknowledgments

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Conflict of interest: Peter Hogg is contracted to the OWIA to liaise with the AIS to implement a testing and fitness program for our Olympic Winter Team.

AFF

Spot check

- Take lessons
- Improve fitness and warm up
- Ski within your limits
- Know the mountain or obtain a good guide!

Table 1. Home fitness regimen

- Aerobic base – 30-60 minutes once per week
- Bike intensity work including hills – 12x40 seconds, twice per week
- Gym work including leg press (one legged), hamstrings, squats and upper body – twice per week recommended for eight weeks pre-skiing
- Agility – 20–30 cm box jumps, 8x30 seconds with two minutes rest or 3x1 minute skipping, twice per week
- Trunk strength – Swiss ball or medicine ball rotation work, 2–3 times per week
- Daily stretching and injury management

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