Physician-directed injury prevention for young skiers and snowboarders

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We have developed injury prevention guidelines and suggestions for physicians to use with skiers and snowboarders. These guidelines are based on data obtained from our 1992 to 1995 research (1) and our more recent study (2), which were designed to obtain information about the knowledge and behaviour of young skiers that might contribute to injury, and to identify factors relevant for physicians to use in injury prevention initiatives was undertaken. The authors then conducted a search for effective injury prevention strategies using MEDLINE. The results of both undertakings were the basis for proposed guidelines for prevention strategies that physicians can use when counselling skiers and snowboarders.

Key Words: Head injury, Helmets, Knee injury, Personal error, Risk, Skier Responsibility Code, Spinal injury, Youth

HEAD INJURY

The high incidence of head and face injuries among skiers (22% of all ski injuries in youths) is a concern. A logical response to this phenomenon is to recommend helmet use, and certainly the reduction in head injury rates achieved in the cycling population through the use of bicycle helmets has been dramatic (5). However, ski and snowboard data do not necessarily support this response, and there are other concerns including the potential for the additional weight of a helmet to load the cervical spine of a child adversely and contribute to the severity of overall injury (6). Helmets tend to make young skiers feel less ‘vulnerable’ and thus promote greater risk taking (7).

Data from the Skier Knowledge Inventory questionnaire (2) indicate that helmets are already used by a high percentage of younger skiers, yet many who injured their head or face were wearing helmets at the time. Other authors report that even major head injury can occur in children wearing helmets (8). It is possible that, in young
people, helmets can alter the ability to hear, see or balance, and thus could contribute to skier error and injury. Further research on the role of helmets in ski injuries is warranted (2). However, pending research-based information on the efficacy and optimum design of helmets, recommending the use of head protection appears appropriate, and others have made this recommendation (9-11). Because facial injury is common, the jaw guard of the helmet should likely not be removed. Parents should be encouraged to set an example by wearing helmets regularly. The fact that helmets are mandatory equipment for ski racers and competitive snowboarders provides support for this recommendation. Physicians should encourage those who ski competitively to promote helmets as ‘cool’ and appropriate gear because this approach has influenced helmet use among cyclists (12). Recent injuries to celebrities while skiing have prompted media coverage that has resulted in adult skiers being more likely to consider helmet use.

**KNEE INJURY**

The knee is the major site of injury for females age seven years and older (1). Although the benefits of prophylactic bracing have been questioned (13), those with knee vulnerability may investigate the potential value of appropriate bracing during skiing. Anterior cruciate ligament sprains are the most common knee injury (14), and braces have been shown to be most effective in protecting the anterior cruciate ligament. Training programs highlighting the mechanism of injury of the anterior cruciate ligaments can also achieve significant (up to 62%) reduction in serious knee sprains (15). All skiers should prepare for the ski season by getting physically fit, paying particular attention to quadriceps function if they are prone to knee injury.

**SKIER ERROR**

The major self-reported cause of loss of control before injury is personal error (1,16). This was also the perception of the young people whom the authors’ surveyed. Skiers’ skill and behaviour influence the likelihood of injury. Adapting to changes in conditions requires the ability to shift abruptly from automatic processing of various tasks to taking more conscious control (17). Expert skiers should tell others about the value of concentration and reducing the probability of injury.

The risks involved with unsafe practices, such as skiing through trees, in rocky terrain, through lift towers and in out of bounds areas, should be explained. Death and serious injury can result from suffocation following falls into tree wells. Head and neck trauma can result from collisions with static objects. Skiing out of bounds can lead to falls over cliffs and hypothermia from exposure even following a minor injury. Exposed rocks early and late in the season also contribute to injury, particularly for jumping snowboarders (18).

**JUMPING**

Jumping is an activity with a disproportionate risk of injury (18). While jumping a mogul with good visibility has little risk, jumping from heights greater than 2 m where visibility is poor, where other skiers may be encountered unexpectedly or where the landing area is not clearly defined, involves unacceptable levels of risk, and can lead to serious injury (18). One study at the authors’ centre found a fourfold incidence of serious spine injury in snowboarders compared with skiers, and 77% were related to ill-advised jumping (18).

**INSTRUCTION**

Parents who have the ability should be encouraged to teach their children and set good examples. The Skier Knowledge Inventory results indicated that younger children in particular are prepared to learn positive skiing behaviours from their parents. If parents doubt their abilities, ski instructors can provide a foundation of skill, which can then be built on when skiing with the family.

Children involved in school-organized ski activities, particularly beginners, have a 25% higher risk of injury than when they are skiing on other occasions (2,19). Parents whose children will be skiing with their schools can work with teachers to ensure sufficient preparation occurs before the event. Orientation, likely provided most effectively by an expert ski instructor or ski patroller, should prepare children regarding the nature of the activity, the equipment, the potential hazards and unsafe behaviour (20). Clearly, all children should know the Skier Responsibility Code and colour coding of run severity. During the actual event, appropriate grouping of students may prevent undesirable peer pressure.

**EQUIPMENT**

Although equipment was not identified in the authors’ study (1) as a significant contributory factor, other studies have shown that it contributes to injuries. Technical improvements in boots and bindings have made ankle injuries infrequent (21), and Bouter and Knipschild (22) demonstrated that in the Netherlands injuries, were reduced when bindings were checked professionally for correct release tension at the beginning of each season. Although skiing patterns in North America differ from those in Europe (North American skiers ski throughout the season, rather than during one annual, two-week ski holiday), there is evidence from the authors’ initial study (1) that individuals other than professionals adjust bindings. This is potentially an unsafe practice. Bindings should be checked and adjusted by a ski technician, probably annually. Old bindings and damaged equipment should be discarded.

**SNOWBOARDING**

Snowboarders are an important group of the alpine sports population. Their numbers are rapidly increasing, and a different and particular pattern of injury associated
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with snowboarding has been recognized (23-25). This group has an alarming incidence of spinal injury (18), particularly as a result of ill advised jumping. The heritage of skateboarding brings with it the desire to jump. Those planning to learn to snowboard should be advised to wear appropriate protective gear and seek proper instruction (23,24) because there is an indication that injuries are more prevalent among beginners (20). This group needs to be aware that as beginners, they are at particular risk of wrist injuries and should wear wrist guards. They should also be encouraged to learn how to fall and acquire jumping skills from experts in an environment that is safe for them as well as for other skiers and snowboarders.

INJURY PREVENTION STRATEGIES

Today society should no longer be satisfied to see the term ‘accident’ used in relation to injuries (3). Despite the excellent record of physicians with injury prevention strategies in a variety of sports, some physicians still feel ill prepared to counsel patients regarding sensible prevention strategies. However, information exists in the literature to help (4). It is essential to know the specific injury data. Key points to increase the impact of prevention counselling include brevity, presentation of the important information first, repetition of key instructions and provision of written reminders. Specific instructions are always more persuasive than general advice. In general, strategies that require a one-time change in behaviour are the most successful.

The media and some skiers and snowboarders promote an aura of great excitement around extreme activities, and peer pressure exerts a powerful influence on individuals to take excessive or unreasonable risks. While it is important that counselling not take all the fun and adventure out of the sport, individuals should understand that once certain risk boundaries are crossed, the rate of injury, the severity of injury and the chance of long term disability following injury dramatically increase (26). Those most likely to avoid injury-causing behaviours are those who recognize that they are susceptible to injury arising from adverse behaviour, see the complications as serious and understand that there are benefits to appropriate behaviour (27). The international literature (26,27) shows the value of positive experience and the acquisition of safe behaviour.

Because of the wide range of factors involved in skiing and snowboarding injuries, it is likely that no single initiative will achieve a major reduction in the rate of serious injury. However, with knowledge of the research data on skiing and snowboarding injuries that now exist and use of injury prevention strategies based on established principles (21) such as those listed above (summarized in Table 1), physicians have the potential to reduce injury rates among Canadian skiers and snowboarders.

### Table 1: Potential injury prevention strategies to use with skiers and snowboarders

| Strategy                                                                 |
|-------------------------------------------------------------------------|
| Seek ways to motivate individuals to adopt injury prevention strategies  |
| Encourage fitness and getting in shape                                   |
| Recommend a preseason equipment check (binding settings)               |
| Consider recommending appropriate equipment to reduce the incidence of the most common injuries, eg, helmets for young people and males, and knee support for females |
| Promote knowledge of the safety rules (Skier’s Responsibility Code)     |
| Teach awareness of the aspects of the sport that carry the greatest risks and encourage choice of appropriate behaviour |
| Motivate skill development (lessons, following expert example, practice) |
| Stress skiing ‘in control’ and explain the need to ski in bounds and avoid natural hazards |
| Set an example as an individual, recommend that parents and others do the same |
| Recommend avoiding exhaustion (download or go down early to avoid run congestion and poor snow conditions) |

REFERENCES

1. Cadman RE, Macnab AJ. Age and gender: two epidemiological factors in skiing and snowboarding injuries. In: Johnson RJ, ed. Tenth International Symposium on Ski Trauma and Skiing Safety. Philadelphia: American Society for Testing and Materials, 1996:58-65.
2. Macnab AJ, Cadman RE, Gagnon F. Demographics of alpine skiing and snowboarding injury: Lessons for prevention programs. Inj Prev 1996;2:266-8.
3. Francescutti LM, Saunders LD, Hamilton SM. Why are there so many injuries? Why aren’t we stopping them? Can Med Assoc J 1991;144:57-61.
4. Stanwick RS. Accident prevention. Med North Am 1989;2:179-81.
5. Joshi NS, Beckett K, MacFarlane A. Cycle helmet wearing in teenagers – do health beliefs influence behavior. Arch Dis Child 1994;71:536-39.
6. Shealy JE, Johnson RJ, Ettlinger CF, Ruskim L. An examination of public policy concerning helmets in snow sports. In: Johnson RJ, Mote CD, Zelcer J, eds. Twelfth International Symposium on Ski Trauma and Skiing Safety. Philadelphia: American Society for Testing and Materials, 1998.
7. Pintal R, Meralta R, Hopper R. The biomechanics of head and neck injuries in skiing. In: Johnson RJ, Mote CD, Zelcer J, eds. Twelfth International Symposium on Ski Trauma and Skiing Safety. Philadelphia: American Society for Testing and Materials, 1998.
17. Weinberg H, Gaetz M. Brain limits. Recovery 1996;7:19-20.
18. Tarazi F, Dvorak MSF. Spinal injuries in skiing and snowboarding. J Bone Joint Surg (B) 1998;80-B(Supp I):13.
19. Ekeland A, Nordsletten L, Lystad H, Holtmoen A. Alpine skiing injuries in children. In: Johnson RJ, Mote CD Jr, Zelcer J, eds. Skiing Trauma and Safety. Ninth International Symposium. Philadelphia: American Society for Testing and Materials, 1993:43-9.
20. VanTilburg C. Surfing, windsurfing, snowboarding and skateboarding. Medical aspects of board sports. Phys Sports Med 1996;24:63-74.
21. Clark C, Doug P. Ski injuries at Whistler. Br Col Med J 1988;30:649-52.
22. Bouter L, Kuipschild PG. Behavioural risk factors for ski injury: Problem analysis as a basis for effective health education. In: Mote CD, Johnson RJ, eds. Skiing Trauma and Safety. Eighth International Symposium. Philadelphia: American Society for Testing and Materials, 1991:257-64.
23. Abu-Laban RB. Snowboarding injuries: an analysis and comparison with alpine skiing injuries. Can Med Soc J 1991;145:1097-103.
24. Gagnon R, Heneveld E, Beranek S, Fry P. Snowboarding injuries. Physician Sportsmed 1992;20:114-22.
25. Pino EC, Colville MR. Snowboarding injuries. Am J Sports Med 1989;17:778-81.
26. Levine RL, Gorman BS. Skiers: perceptions of danger are the function of awareness of fatalities. J Sports Behav 1994;17:17-23.
27. Kok G, Bouter L. On the importance of planned health education: Prevention of ski injury as an example. Am J Sports Med 1990;18:600-5.
28. Damoiseaux V, de Jongh A, Bouter L, Jan Hosper H. Designing effective health education for downhill skiers: Results of a randomized intervention study. In: Mote CD Jr, Johnson RJ, eds. Skiing Trauma and Safety: Eighth International Symposium. Philadelphia: American Society for Testing and Materials, 1991:241-8.