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Wrist Injuries in Snowboarding

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Snowboarders, once a radical fringe on the trails and the bane of skiers (“they just push all the good powder right off the slopes”), have now become the backbone of the ski industry. The slopes are covered with a combination of “riders” who started on snowboards and have never ventured onto “two planks”, as well as cross-overs from the ski world looking for a new challenge. Typical of a new sport trend, this charge down the mountain was led with seeming reckless abandon by America’s youth.

Unfortunately, not every trip to the bottom of the lift ends with a smile and a boost of adrenaline. Even young people need a learning curve, and the price of their education is seen at clinics and emergency rooms throughout ski country. The witnessed carnage gave rise to parents and E.R. doctors lamenting a sport that clearly was not going away. Some ski areas even banned snowboarding, citing injury and trail damage as reasons, but really because of fear and snobbery. While the proposition that snowboarding ruined the slopes for skiers has been proven fallacious, the question of bodily harm needed more exploration.

In the late 1980’s, data began to be collected on injuries to snowboarders. Certainly snowboarders were breaking their wrists at a higher frequency than skiers, but happily they were sustaining fewer knee injuries. These earlier studies were difficult to analyze, however, due to the wide variability in equipment used by snowboarders and their differing skill levels. Just as there has been a learning curve in skill level, there has been a learning curve in equipment. Far from the days of inexpensive “snurfers” (snow-surfers), today’s snowboards are high-tech tools of varying length and

width, depending on the type of riding to be emphasized. Racing boards tend to be longer, with an hour-glass shape and ski-like metal edges to facilitate carving turns around poles. These giant slalom type turns are very similar to those performed in ski racing. Snowboard racing has become intensely competitive and a popular event in recent winter Olympics.

What most people think of as snowboarding though, is the baggy-pants, “freestyle” events seen on “extreme” sports competitions. These symmetric boards are designed for trick riding – flips, spins, slides down railings, jumps over objects, etc. The “pure” form of these competitions take place in specially made “half-pipes” carved out of the snow. Not surprisingly, they resemble the lower half of a large water conduit with steep walls and a slight downhill slope, allowing for increasing speed. Not only is the lead foot changed often during the course of the competition, but both hands are used for balance, pivoting maneuvers, speed control and, of course, braking and protection during a fall.

Just as board technology has advanced, so too has boot and binding design. Early snowboards consisted of strapping your winter boots onto the board. Now, in most cases, snowboarders own or rent a specially designed boot that locks onto the board. The upper part of the high-topped boot is predominantly soft for comfort, with some firmer plastic elements for increased support. The competitive giant slalom racers tend to use a full hard plastic boot similar to skiers.

Many school districts in ski country have programs that allow children to participate in winter sports on a weekly basis. The kids are often given a choice of skiing, snowboarding, or some other (usually less exciting) winter sport. In 1994, I decided to set up a study that would attempt to eliminate as many variables as possible in deciding which sport, skiing or snowboarding, would allow a parent to rest easiest as their child participated.

Understanding that the athletic fields (or slopes!) are never completely safe, I was not convinced that snowboarding was any more dangerous than any other high speed activity. To compare “apples to apples,” my initial study evaluated over 22,000 participants in “Learn to Ski” and “Learn to Snowboard” programs¹. These folks were rank beginners and all used similar rental equipment. The numbers were

remarkably similar, with some 4% of each group sustaining an injury that required treatment at the mountain emergency clinic. Consistent with previous early studies, the results of our study also documented a higher percentage of upper-extremity injuries, most commonly wrist sprains and fractures. There was also a higher incidence of concussions in snowboarders as they were prone to backward falls in a turn to the front-leg side. The good news for snowboarders was, since their feet are locked in place and the board is turned with the entire body, the incidence of knee injuries is far less than their skiing brethren. In fact, the only anterior cruciate ligament (ACL) injuries I have seen in snowboarding are a result of the same mechanism: landing from a jump with the weight on the front leg. This causes a hyperextension, twisting, force that results in an ACL tear. I have not seen ACL injuries in these athletes in conjunction with other knee ligament injuries such as in skiing, where the ski can unwind the knee causing the classic “terrible triad”. It was my sense, therefore, that if we could decrease the injuries to the wrist, and, as a bonus, injuries to the head, we would greatly reduce the trauma of snowboarding and actually make it significantly safer than skiing.

In 1998, I began a study of the same group of snowboarders, i.e., rank beginners enrolled in a “Learn to Snowboard” program². An attempt was made to randomly assign an “off-the-shelf” wrist guard, originally designed for in-line skating, to participants. The results were even better than expected. Not one of our novice snowboarders sustained a wrist injury on the day of their lesson. More encouraging, there were no hand, elbow or shoulder injuries either, indicating the wrist guards were not transmitting the forces significantly to other areas of the upper extremity. In this study, over 2300 boarders were followed with no injuries to the 551 participants who were protected and forty injuries in the non-protected group ($p < 0.01$). No attempt was made to customize the guards as only one size was available.

Colles described the fracture of the distal radius in 1814, with the most common mechanism being a fall on an outstretched hand. Previous studies have found the amount of force necessary to produce this injury as between 105 and 440 kg. This mechanism is the most common for our snowboard population

as, not only are they thrown forward and backward involuntarily onto often hard snow but, as discussed earlier, snowboarders use their hands voluntarily in trick maneuvers. Indeed this is the difference that separates snowboarding from many other sports: it is both an upper and lower extremity activity.

Several excellent cadaver studies have been published recently analyzing the effect of wrist guards on protection of the distal forearm. Unfortunately, as alluded to in reference to the clinical studies, it is difficult to compare them due to the varied testing conditions. In 1997, Giacobetti, et al.³ tried to determine commercially available wrist guard's effectiveness in 20 cadavers (40 arms). Their loading conditions consisted of a Servo Hydraulic Material Testing System loading the specimens to failure. No statistical difference was found between guarded vs. unguarded forearms in these conditions.

A year later, Greenwald et al.⁴, attempted to determine the effectiveness of in-line skating wrist guards in preventing wrist fractures during a fall. Their testing of only six cadavers in dynamic impact testing conditions suggested that wrist guards may have a preventative effect during such loading.

A third paper was published in 1999 by again looking at the effect of wrist guards but this time loading only to sub-failure levels.⁵ Testing two types of guards, they found both effectively reduced dorsal and volar distal radius bone strain. They concluded that wrist guards might function partly by load sharing and absorbing impact energy. Although the cadaver evidence is somewhat contradictory, the trend seems to be that wrist guards do provide some protective benefit. While my clinical study of snowboarders clearly showed the benefit of these braces, a paper looking specifically at in-line skaters (the sport these braces were designed for) also demonstrated clear decreases in wrist injury rates in the braced population.⁶

Though all the evidence in the world might prove the effectiveness of a product, this does not mean people will use it. Unfortunately, like most other activities, fashion trends do not always follow safety. Optimistically, a minor revolution has taken place on the ski slopes over the past few years as the use of helmets has become not just acceptable, but almost fashionable. The reason for this, I dare say, is not because doctors and parents have asked and encouraged such behavior, but because ski idols such as

Herman Meier wear one. The snowboard culture is a bit behind on this trend, especially among the freestyle snowboarders. If the hot snowboarders competing in the Salt Lake City Olympics all wore helmets whenever they were on the slopes (not just in competition), we would see this shift in snowboarding. Likewise, I believe the same could be said of wrist splints. First, wrist splints (as well as helmets) should be a standard offering at rental shops. Indeed, shop clerks should hand people wrist splints with a copy of my study if they need convincing. Secondly, as manufacturers see a market for these braces, they will be made even more comfortable for use with snow jackets, giant slalom suits and other ski apparel. One word of caution: the braces used in my study and the cadaver studies are strong, thick plastic devices secured snugly with Velcro straps. I have seen a wrist fracture in a snowboarder with “wrist guards” built into his gloves. These were too flimsy, too loose and too short to afford significant protection.

Finally, there is nothing in the cadaver studies, clinical studies or anecdotal experience that would lead us to believe these braces would not be effective in all levels of snowboarders. It is easy to say “but these braces only protect beginners traveling at slow speed”, but this argument lacks credibility. The beginners that are hurting themselves are not falling over in a lift line; they are traveling out of control at a high speed - the same mechanism that injures experienced snowboarders. I dare say that all snowboarders, at all levels, can benefit from protective equipment without loss of fun or function. While I’m not encouraging an act of legislature, I do believe that making people aware of safety equipment that does not hinder enjoyment of this sport is not only appropriate, it’s good business.

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