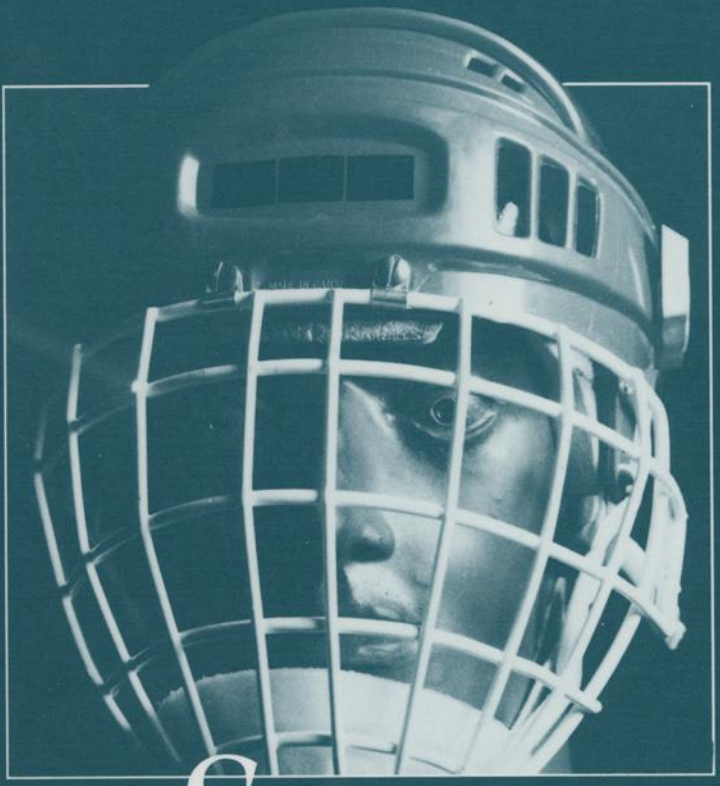

Safety in ICE HOCKEY

SECOND VOLUME

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C. R. Castaldi, P. J. Bishop, and E. F. Hoerner, editors

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Dedication—Bob Johnson, 1931–1991

This symposium is dedicated to Bob Johnson, hockey player, coach, and administrator whose dedicated leadership, enthusiasm, and kindness touched almost everyone associated with the sport of ice hockey. A native of Minneapolis, Minnesota, he began playing the game long before the birth of organized high school hockey in that city. His first experience as a combined player, coach, and manager occurred before the age of 15 at Central High School, Minneapolis, where he organized a team of fellow students to compete against other unorganized local high school teams, not for championships, but for fun.

After high school, he attended the Universities of North Dakota and Minnesota and played on both their hockey and baseball teams. Following graduation, he served in the Armed Services in the Korean War where he voluntarily organized hockey and baseball games between the services and played himself. After that war, he returned to Minnesota and played one year of professional hockey in Warroad and then signed a minor league professional baseball contract. As he and his wife Martha's family began to grow, he retired as a player and spent six years as a teacher, football, baseball, and hockey coach at Minneapolis' Rosedale High School.

Bob's reputation as a coach quickly grew. He accepted his first college coaching position at Colorado College in Colorado Springs. From there, he went to the University of Wisconsin as Head Coach and led the Badgers to seven NCAA tournaments, winning the championship in 1973, 1977, and 1981. He became known as "Badger Bob" for his success and especially for his infectious enthusiasm for the game.

Internationally, he coached the 1976 U.S. Olympic Team to a fourth place finish at Innsbruck and then Team U.S.A. in the 1981, 1984, and 1987 Canada Cup tournaments. In 1982, he served as Head Coach for the Calgary Flames and led them to the Stanley Cup Finals in 1986.

Bob then gave up coaching to be Executive Director of U.S.A. Hockey for three years but returned to professional coaching for the 1990–91 season and led the Pittsburgh Penguins to its first Stanley Cup Championship.

Bob's concern for safety started early in his career. As a college player at North Dakota, long before the advent of today's hockey helmets, he voluntarily wore a football helmet following a head injury. As a high school and college coach, he enthusiastically supported playing rules related to player safety but expressed caution about the effect of overprotection on changing the nature of how the game is played.

Foreword

The Second International Symposium on Safety in Ice Hockey was presented at Pittsburgh, Pennsylvania, on 20–21 May 1992. ASTM Committee F-8 on Sports Equipment and Facilities and its Subcommittee F08.15 on Ice Hockey sponsored the symposium. It was cosponsored by The Hockey Equipment Certification Council. C. R. Castaldi served as chairman and P. J. Bishop, Waterloo University, served as co-chairman of the symposium. C. R. Castaldi, P. J. Bishop, and E. F. Hoerner are editors of the resulting publication.

Contents

Overview

The first ASTM-HECC symposium on **Safety in Ice Hockey** was held in Montreal, Canada in October of 1987. In the Overview to the published proceedings of that symposium, the editors, Castaldi and Hoerner, suggested that future symposia on safety in ice hockey should include such areas as conditioning programs, physiology, nutrition, psychological factors, improved injury protection for goal keepers, and severe shoulder injuries among others. Several of these areas were addressed in this second Symposium on **Safety in Ice Hockey,** as well as updated information related to epidemiological factors, injury treatment modalities, playing facilities, and protective equipment.

Issues of safety in sport in general, and ice hockey in particular, are frequently discussed in household kitchens, in social settings of many kinds, in academic offices, and on radio or television talk shows. Quite often the focus of concern is a recent injury to a professional superstar, causing discussions that become highly charged and are based on anecdotal information or preconceived opinion. While such discussions can be quite entertaining or even cathartic, advancements in sports safety are best made through sound scientific inquiry. The number of scientists working in the field of hockey safety is not large, but many of them have made a valuable contribution to this symposium. Through this publication, the results of their work will be available to hockey administrators; equipment standards and certification bodies such as ASTM, the Canadian Standards Association (CSA), the Hockey Equipment Certification Council (HECC), and the International Standards Organization (ISO); and health professionals, players, coaches, officials, and parents. Hopefully, they will be aided by these works in their quest to make ice hockey safer for all those involved.

Unfortunately, very few people, even individuals who are closely involved with the sport, are aware of how governing hockey bodies, health professionals, standards organizations, educators, and equipment manufacturers have responded to safety issues that surfaced as the sport evolved during the last quarter century. For example, during the 1965–1970 period, when studies revealed that oral, facial, head, and catastrophic eye injuries comprised the major portion of all hockey injuries, CSA, ASTM, and the Swedish Institute for Standards developed national standards for helmets and face protectors. The amateur hockey bodies of all three countries quickly adopted their new standards with impressive results. Not only were the major hockey injuries of the pre-1975 period virtually eliminated, but the high cost of health care services associated with the treatment of those injuries all but disappeared.

But, as the speed and intensity of the sport and the size and strength of the average player over the age of 16 greatly increased during the 1975–1985 period, the pattern of hockey injuries drastically changed. Knee and shoulder injuries and catastrophic spinal cord injuries, the latter virtually nonexistent before 1975, began to dominate, even though the injury rate for players under the age of 15 years was declining [*1*]. Were these unexpected new injuries in the over 15 years of age range a result of (1) the increased size and strength of players, (2) increased intensity of competition and associated coaching strategies, (3) inadequate protective equipment, (4) playing rules, (5) the playing facility itself, or a combination thereof? The purpose of this symposium was to address these issues. For review purposes, the papers are grouped under four categories: Epidemiology and Conditioning, Behavior Factors, Playing Facilities, and Protective Equipment.

Epidemiology and Conditioning

Tator, Edmonds, and Lapczak report on what is undoubtedly the most comprehensive study thus far of hockey-related spinal cord injuries. It covers the period 1966 to 1991 and involves 182 North American injuries, 94 of which occurred in Ontario, Canada, 77 in the rest of Canada, and 8 in the United States. Of these, 138 (75.8%) involved the upper spine, and 41 (22.5%) suffered complete permanent spinal cord injury with no preservation of motor or sensory function below the level of the injury. There were 6 deaths. The most frequent cause was a push or body check from behind or a trip or fall in which the player collided head first against the boards with the head in a flexed position. The age range was between 11 and 50 years, the median being 18 years; 7 were women. The authors reviewed all possible causative factors as described in the above Introduction but could not identify any as more significant than another. What is most disturbing, despite serious educational efforts beginning in 1985 by all hockey organizations, is that this potentially catastrophic injury is not declining. Among the numerous proposals for reducing its frequency are neck muscle-strengthening exercises, increasing the size of the playing surface, and the adoption of a "Play Hard, Play Fair, Nobody Hurt" philosophy by all players and coaches.

Using the National Collegiate Athletic Association (NCAA) Surveillance System (ISS) adopted in 1982, Dick reviewed injuries in U.S. Collegiate Ice Hockey from 1985 to 1990. The study is unique for two important reasons: (1) the consistency of the method and (2) there were no major equipment or rule changes during the study period. Thus, for the first time, it was possible to evaluate trends in hockey injuries, and even more importantly, comparisons could be made with many other collegiate sports whose injury rates were being compiled during the same period. Ice hockey has a lower practice injury rate than basketball, football, and men's lacrosse. In fact, only baseball's practice injury rate is lower. The game injury rate, however, is six times the practice rate, about the same as men's lacrosse, and although lower than football, hockey's game rate is significantly higher than basketball. Despite concerns expressed by Walsh [*2*] during the 1985 Safety in Ice Hockey Symposium to the effect that hockey injuries were completely out of control, there has been only a slight increase in NCAA ice hockey injuries between 1986 and 1990 and a return to the five-year average for the 1991–1992 season. Whether the 1991–1992 year was due to an increased effort by officials and coaching staffs to eliminate body checks from behind is not clear at this time. Concussion injuries, which constitute 5% of all injuries did not increase, a finding that may be deceiving because many of the less severe concussions would not be included if the injured player did not miss a practice or a game. During its 1993 Midwinter Meeting, HECC recommended that the impact requirements for hockey helmets be increased to provide better head protection.

Bancroft has compared studies of ice hockey injuries before and after the full face protection rule of 1976. Using a modified version of the NCAA ISS system, he studied the injury experiences of the University of North Dakota (UND) hockey team for the 1988 and 1989 seasons and compared them to the five-year NCAA study. The UND practice injury rate was double the NCAA rate, while the game injury rate was half the NCAA rate. Defensemen were injured more frequently than forwards, the reverse of the NCAA study. There were also differences in the type of injury, sprains being more frequent for UND players compared to contusions in the NCAA study, which the author attributed to a slightly different reporting method. He also made a number of excellent proposals for preventing injury.

Bernard, Trudel, Marcotte, and Boileau reported on a 2-year injury study of 5 Quebec Bantam (14–15 years) hockey leagues, 2 in the Quebec City area and 3 in the Ottawa area. In the Province of Quebec, young amateur players were grouped by age and level of ability. The study involved over 300 games, all observed by trained observers, some of whom also interviewed the players after the games to confirm the findings. In cases of severe injuries, follow-up phone calls were made to the injured players to confirm the diagnosis and the circumstances of the

injury. The studies also included anthropometric (height and weight) and biomechanical (force of impact) profiles before the playing season. Comparisons were made of the injury experiences of AA and CC teams both of which participate in highly competitive games that allow body checking. AA and CC players differed significantly in age, weight, height, and grip strength all in favor of AA players, but there were no differences in skating speed and in force of impact tests.

Twelve teams were targeted for the study. Disparities in age, weight, height, speed, and force of impact were greater for the Class CC players. Interestingly, there were significant differences in injury rates between the Ottawa and Quebec City leagues (geographically 450 km apart) for both the AA and CC players. The number, type, and range of minor injuries were described in greater detail than most studies and even included dizziness after injury which comprised 9.1% of the total. Was dizziness an indication of mild concussions? The major injuries were fractures, sprains, dislocations, concussions, and "others" which included the more serious types of contusions, muscle strains, lacerations, and injuries to internal organs. The most frequent cause of major injury was body checks received, 64.7% in 1987–1988 and 53.1% in 1988–1989. Combined with body checks given, the rates for the two years were 68.7 and 75%.

While the authors found no significant difference in minor injuries between seasons, there were differences between the two regions that the authors attributed to the data collection method. In the Quebec region, the observers were permitted to assess carefully the injuries and question the players, while in the Ottawa region they were not allowed in the dressing rooms, instead receiving the information from the trainers and coaches. It was concluded that the coaches may only be aware of the obvious injuries. Readers specifically interested in the 12- to 15-year age group of youth players are urged to review this very detailed study as it may shed more light on the unresolved controversy over what is the most desirable age range for the Pee Wee and Bantam player categories.

Gilder and Grogan studied the effects of a twelve-week off-season strength and conditioning program for previously injured junior hockey players and compared the results to a nonconditioning program group of comparably injured players from the same team. Pretesting evaluation consisted of seven objective tests followed by eleven resistance training procedures performed twice weekly. Both the treatment and nontreatment groups were evaluated for injury experience during the following playing season. The nonprogram group had twice the number of players yet had three times the number of injuries as the program group. The postinjury rest time for the nonprogram group was also longer. The program group had no missed days for any of their minor injuries. Although previous studies negate the idea of resistance training to prevent injuries, the data from this study are significant enough to represent a pilot program for further study of resistance training for reducing the number of minor injuries and the time needed for them to heal.

Behavior Factors

Many individuals closely involved with ice hockey believe very strongly that the recent increases in injuries as a result of aggressive checking are related to uncontrolled behavior of players and coaches. This section reviews the subject of behavior in relation to Oldtimers hockey, youth players, coaches, and game officials and includes various proposals to modify unacceptable behavior.

Adams and Montelpare report on what is probably the first study of players over 35 years of age who compete essentially in recreational "fun hockey" groups now known as "Oldtimers" hockey, a new category of the sport that has grown rapidly during the past decade. While most Oldtimers may not compete in organized leagues, such leagues are growing in number and most do not allow body checking or slap shots. There are no requirements for protective

equipment, and many players prefer to skate in a sweat suit relying only on shin pads, hockey gloves, and a helmet for injury protection until, of course, they get a painful injury from a fall or an accidental collision after which more protective equipment is often worn. But, as Pashby has repeatedly reported, the Oldtimers have the fastest growing rate of hockey-related blinded eye injuries. Organized hockey administrators are being called upon to assist Oldtimers in setting up competitive programs including special rules and injury insurance; thus, the need for reliable information about injuries, conditioning, skill level, and the behavior of this newly emerging group of hockey enthusiasts.

The present study is based on questionnaires answered by members of the 6-team Jordan Ontario, Canada Oldtimers League which has operated continuously for many years, averages 108 players per year, and plays a 20-game schedule plus playoffs. Questions included (1) why participate, (2) what benefits are expected, (3) what is the injury experience, and (4) does the sport provide fitness benefits which might be better acquired by alternative leisure activities? The findings indicate that fun and the social aspects are the chief motivators for participation, the once-a-week activity is considered a valuable stress reducer, there is very little preparation for the physical stress of play, and most injuries are musculoskeletal resulting from contact with an object. In Canada, a country that has national health care insurance, most Oldtimers hockey players seem insufficiently concerned about face and eye injuries to wear a face protector. This study is an important start, and much more information is needed, not only to improve safety in Oldtimers hockey, but also to help reduce the cost of health care for the treatment of injuries in what is essentially a leisure sport.

It is well known that hockey coaches behave quite differently depending on whether their teams are winning or losing and that their players respond accordingly. Many believe that a violent reaction by a coach to a referee's unfavorable decision during a close game can incite violent behavior by team members. There have been recent examples in Canadian Junior hockey at the national and international level in which coaches have been accused of inciting unsportsmanlike conduct in their players. Cote, Trudel, Bernard, Boileau, and Marcotte report on the behavior of 23 Bantam team coaches during 65 games when their teams were winning or losing by widely different scores. Previous studies have shown that, when losing by more than two goals, Bantam level players tend to be more penalty prone. In the present study, coaches tended to disagree with the referee more when losing than when winning. Yet, in losing situations, while obviously disagreeing with officials, the coaches tended to encourage their players to obey the rules. It is an interesting and valuable study, and while the authors took great care in their study design not to influence the coaches' behavior, it may not be possible in today's research environment of informed consent to design a completely objective study. It is also quite possible that the bad public image the sport has engendered over the past few years is actually having a desirable effect on coaches, and the findings in this study are actually predictive of a new era in coaching behavior. If so, hockey safety will surely benefit.

Does the quality of officiating vary between professional, university, and minor hockey leagues? There is no doubt that the quality of officiating can influence the behavior of players and, as such, the outcome of games. Spectators who attend a wide variety of hockey games often comment on what they believe are wide disparities in the quality of on-ice officiating. Those spectators who attend many professional games often comment that officials, when they were linesmen, had absolutely superb vision, but as soon as they become full-fledged referees, the quality of their eyesight seemed to change. Amateur youth coaches who attend college games complain bitterly that the referees rarely call penalties for cross checks to the face; the referees seemingly have adopted an attitude that because all the players wear full face protectors, and since facial injuries rarely occur, there is no reason to call an infraction penalty. Audette, Trudel, and Bernard have studied whether there actually are differences in officiating

in junior, university, and professional leagues. Game reports were analyzed over a three-year period using four categories of penalties: tactical (tripping, holding), minor aggression (2-min penalties for roughing, slashing), major aggression (fighting, high sticking), and "others" (misconduct penalties). There were fewer total penalties in the National Hockey League and fewer major aggression penalties in the university league in which fighting resulted in an automatic game penalty. The authors concluded that, with the exception of the fewer number of penalties in the professional league, differences in the number of penalties were due to minor variations in the rules of each league rather than a difference in the quality of the officiating.

Trudel, Bernard, Boileau, Marcotte, and Audette compared the penalty experience and game performance of Bantam players (14–15 years) in four Province of Quebec leagues, two AA and two CC teams in the Ottawa and Quebec City areas. All teams had a comparable number of penalties, and 488 game reports were analyzed. To evaluate player performance, 7 games were televised for each team to record the number of minor aggressive body checks, shots on goal, goals, and assists by each player. Although forwards and defensemen were included in the study, only the performance of the forwards was compared. Forwards who gave more body checks were more productive scorers and also received more minor penalties. Of the aggressive penalties, 46% were taken by only 20% of the players. Players with many minor penalties, but who gave fewer body checks, did not perform as well as those who gave more body checks. Since it is known that illegal body checks generate more injuries, the authors recommend educational programs for coaches and game-scoring methods that would reward teams with fewer penalties. Both proposals are presently being tried in the Province of Quebec.

Ice hockey, once the most popular sport in Canada, is no longer so, having been replaced by soccer football. The loss of 100 000 minor hockey players between 1980 and 1990 is described by Marcotte and Simard as a "hemorrhage" which, to be stopped, requires eliminating the excessive violence that has crept into the sport and replacing it with good sportsmanship if hockey is to regain the popularity and respectability it once enjoyed. Aggression in hockey is defined as a nonaccidental act intended to do harm to an opponent. Numerous causes are cited including score differentials late in home and away games. Many methods for controlling aggression without changing the basic nature of the sport are offered.

Widmeyer and McGuire review many of the recent examples of parents, hockey administrators, and various levels of coaches, even prominent NHL ones, who have begun to express negative views about the increase of violence in hockey. In the United States, the sport is widely played in only a few states, yet millions of people are exposed to professional hockey games several times a week in the season, almost all of which include at least one barefisted fight. Yet the problem is not confined to the professional player. The average number of aggressive penalties assessed in a study of Canadian Junior "B" hockey was 19.7 per game compared to 11.1 for the National Hockey League. Amateur players, even Pee Wees, ages 12 and 13 years, freely admit a desire at least once a game to injure an opponent. Extensive studies have been done on the aggressive behavior of hockey teams while winning and losing and at various times during home and away games. Fighting must not be allowed at any level of play. The authors review and support the proposals of Vas of the University of Nebraska who devised a scoring system that awards a score of 7 for a "clean win" which is defined as a winning team having fewer penalties than its opponent and 6 points for a tie in which each team has an equal number of penalties. The system reduces the number of points awarded depending on the various combinations of wins, losses, ties, and penalties including a score of minus 1 for a team that loses a game and had more penalties than its opponent.

There is some evidence that players born in the first quartile of the year have an advantage in ice hockey success, but the issue has not been thoroughly studied. Larivière, Nicoletti, Bossi, and Milani report on 107 elite Bantam players aged 15 years and found that in terms of 9 off-

ice physical tests and 9 on-ice skill tests, there was no significant difference between quartiles of the year for any of the technical, physical, or fitness characteristics with the exception of skeletal age. Players born during the fourth quartile were significantly younger in skeletal maturity which the authors conclude is a competitive disadvantage. The recent decision by USA Hockey to restructure the age range of its playing categories by lowering the age range for Pee Wees and Bantams to 11–12 and 13–14 years, respectively, and the eligibility date to June 30 from December 31 is quite possibly the most desirable method for overcoming the discrepancy in the size of players in these two youth categories.

At age 15 years, almost all highly skilled American and Canadian hockey players find themselves having to think seriously about the possibility of a professional hockey career, how it might interfere with their education, and wondering if it is possible to combine higher education with a career in a professional sport that pays well and is expanding rapidly. Because of the unique nature of sports in the United States in which almost all amateur sports function within the high schools and the universities, hockey coaches play an important role in the future lives of their student athletes. It is especially so at the present time when public concern is rising about the ethics of recruiting world class athletes to improve prestige and generate revenue for higher education. Chouinard and Blann have surveyed NCAA hockey coaches about current college hockey issues and found the coaches' priority concerns to be the academic performance of student athletes, game officiating, recruitment, and the amount of physical play. The authors conclude that coaches, athletic directors, league commissioners, and game officials must work together to initiate necessary reforms.

Playing Facilities

A number of authors in this symposium publication, Tator et al., Dick, and Bancroft have referred to the rink boards as a potentially hazardous object, yet very little information is available to provide guidelines for a safer ice hockey playing environment. Such information is needed for the renovation of older rinks and the construction of new ones.

Few studies have dealt with the correlation between injury and geographical area on the ice surface. Clayton has analyzed data from a 3-year study of 1185 injuries in the Canadian Major Junior Hockey League in which 43 teams consisting of 1075 players participated in 216 games and 600 practices. The injuries were recorded on a diagram of a rink in the zone area of the ice surface where they occurred. The highest number of injuries (19%) occurred in the neutral zone of the rink and the lowest (6%) in the area behind the goal. The corners in the home end of the rink had more injuries than the same area in the visitor's end, but there were more injuries in the area in front of the visitor's goal. The sites where board contact injuries occurred were not recorded, but the rate of shoulder injuries and those injuries classified as neurotrauma suggested that the boards may be a factor because those injuries occurred more frequently in the corners near the boards.

Brauer, Spengler, Lee, and Yanagisawa studied the quality of indoor air in enclosed ice hockey rinks using fuel-powered resurfacing equipment which have the potential of creating serious health problems from elevated levels of carbon monoxide (CO) and nitrogen oxide (NO_2) from the exhaust emissions of internal combustion engines. They investigated the range of NO_2 exposures encountered in typical rinks under normal operating conditions including information on the physical characteristics of the building (size, ventilation, and so forth), resurfacer use, and resurfacer maintenance. The median NO_2 level inside the rink was 180 ppb which was more than ten times the median outdoor concentrations. One-week average NO_2 concentrations of over 1000 ppb were found in 10% of the rinks. Of all the attempts to reduce

the pollutant, only full operation of the rink air exhaust system combined with a reduced number of resurfacer operations decreased NO_2 levels below reference limits.

Protective Equipment

Protective equipment in ice hockey is used for the purpose of reducing the risk of injury associated with the physical contact, both intentional and incidental, that is prevalent in the game. Where equipment is properly used, the frequency of injury is often reduced as illustrated in the paper by Pashby, who provides a historical review of eye protection. Because of a large number of blind eyes associated primarily with hockey sticks (43 blind eyes in 1974–1975), eye protectors were developed, and standards for their manufacture were introduced in 1978. No blinding eye injuries have occurred to players wearing CSA certified protectors. As a result, visors are now certified by CSA, and it is hoped that this device will be accepted and worn by those playing Oldtimers hockey. While no blinding eye injury has been recorded for a player wearing a visor, it is important that this device be worn properly.

Organized youth, high school, and college hockey in the United States have playing rules that mandate the use of a mouthguard. Castaldi has reviewed the history of the mouthguard beginning in the early 1930s when it was first used by the sport of boxing to reduce the possibility of concussion from blows to the jaw, up to the present time when football, field hockey, and field lacrosse teams are also required to wear mouthguards. The various types of mouthguards are described including what types are best suited for which sports. Mouthguard compliance in youth and high school hockey is the responsibility of the game officials in cooperation with the coaches, while in the colleges, the coaches are responsible for monitoring compliance. Only about one third of all college players comply with the mouthguard rule, and efforts have been made to discontinue it despite a 5% annual concussion rate. In the opinion of the author, rather than eliminating the rule, college hockey teams should appoint team dentists knowledgable in sports dentistry who would not only provide the proper type of mouthguards for college level players but would also provide emergency dental services throughout the playing season as well as oral examinations as part of each player's preseason physical examination.

Certification of hockey helmets under CSA or ASTM standards requires impact testing that simulates blunt trauma and assesses the helmet's ability to protect against diffuse brain injury. There is no test for localized trauma such as that induced by a hockey puck travelling at high speed. The paper by Bishop and Arnold is the first to examine the ability of hockey helmets to limit localized pressure under puck impacts. By using Fuji pressure-sensitive film applied against the temporal region of a humanoid headform, pressures ranging from 15 to 28 MPa for puck speeds of 100 to 140 km/h^{1} were recorded in six models of hockey helmets. These values were five to eight times larger than the reported fracture tolerance of the temporo-parietal area of the human skull. Peak headform accelerations were below 250 *g* for all helmets at 100 and 120 km/h^{1} but exceeded 275 *g* in four models at 140 km/h^{1}. Severity Index (SI) values indicated a concussive head injury risk of less than 2 to 5% for these impacts. The SI and peak *g* measures were not useful for determining focal injury risk caused by puck impacts, suggesting that additional test procedures, involving the direct measurement of force, be included in future certification standards.

While protective equipment is expected to reduce the risk of injury, there are some who have expressed concern that such equipment is often misused, leading players to engage in on-ice behavior that is both unsafe and unacceptable. This notion was explored by Stoner and Keating whose review of historical changes in hockey equipment, injury statistics, and game

dynamics provides the basis for a real concern that players have become invincible warriors doing battle on the ice in a suit of body armor. Whether this perception is true requires more thorough investigation, but the issues raised make it very clear that protective equipment must be used for the purpose for which it was intended and not as a license to practice on-ice mayhem.

While protective equipment is vital to the game of ice hockey, there are very few standards in place to ensure that protective devices will perform as intended. To date, only ice hockey helmets and facial protectors are certified under ASTM, CSA, and SIS standards. An ASTM skate blade standard exists and certification occurs through HECC. Because of problems related to the manufacturing of equipment under several standards, there is an increasing need for an international standard that will satisfy the requirements of players and manufacturers worldwide. Dixon and Brodie provided an update on the progress that has been made toward an ISO standard for helmets and face protectors. Previous work in this area has been slow and painstaking, but most objections raised by member nations have been satisfactorily addressed. The recent creation of a Comité Europeen de Normalisation (CEN) to develop a standard for ice hockey helmets and face protectors for use in the European Community has complicated the goals and work of ISO Technical Committee 83/Subcommittee 5. It may well be that by harmonizing the existing CSA and ASTM standards, a set of North American Standards for helmets and face protectors will be put in place long before an ISO standard is realized. In any event, the publication of Draft International Standards (DIS) for both helmets and face protectors, incorporating dynamic impact and objective optical tests, is expected by the end of 1993.

C. R. Castaldi

University of Connecticut Health Center
Farmington, CT; Symposium Chairman and editor.

P. J. Bishop

University of Waterloo
Waterloo, Ontario, Canada; symposium cochairman and editor.

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