

Relating Overuse Injuries to Time On Ice in Hockey Players

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Abstract

Ice hockey is becoming an increasingly popular sport throughout the globe. The quality of hockey being played is constantly reaching new levels that have not yet been experienced. As a result speed, acceleration, strength, power, reaction time and quickness of the game have all increased. These changes have led to players being in much better physical condition than in the past however this has also led to increased injuries. More injuries are occurring for various reasons. Most people would attribute this rise to the increasing amount of contact there is in hockey and they would be partially right. However another element to look at is the strains and stresses the body of the athletes is undergoing to simply achieve their current fitness levels and to partake in such a grueling sport. Many players are suffering injuries resulting from overuse, overtraining, and fatigue. These injuries are prominent in the game of hockey and will be discussed further in this paper.

Keywords: Injury, surveillance, hockey, time on ice

Introduction

To get a general idea of other people's opinion on the issue of injuries relating to Time On Ice, we conducted two surveys. Survey 1 was geared toward players, and survey 2 was geared toward a broader spectrum of hockey types. Survey 1 yielded 16 opinions of elite hockey players aged 15-26 ranging from the national level (Team Canada) to AA and competitive level. Survey 2 yielded 71 responses, 52 of which were from physiotherapists, team physicians, strength and conditioning coaches or athletic trainers. The remaining 19 were from others highly involved with a hockey team such as managers, coaching staff, etc.

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The incidence rates in hockey greatly vary according to the level of play, the age group, the league rules, and simply the overall level of competition. Various studies have been done delineating the rates according to the players being studied. Rates as low as 30-34 injuries per 1000 player-game hours in high school players (Smith, Stuart, Wiese-Bjornstal, & al., 1997) (Agel, Dompier, Dick, & Marshall, 2007) to up to 134 injuries per 1000 player game hours in Junior A players (Stuart & Smith, 1995). Many studies found varying rates between these for various levels including the Finnish National League at 66 injuries per 1000 player-game hours (Molsa, Airaksinen, Nasman, & Torstila, 1997). Ranges like these are observed because of different criteria and definitions of injuries when researchers are gathering data. It was a homogeneous finding that injury rates were much greater in competition (games) than in practices. This is due to the greater stresses imposed on the bodies of players during games. Up to 25 times higher injury rates were found in games versus practices (Murphy, Connolly, & Beynon, 2003). The incidence rates discussed above pertain to all hockey injuries. However, in this study we are focusing specifically on overuse injuries. It was estimated that 80% of injuries are caused by trauma, and 20% are caused by overuse (Lorentzon, Wedren, & Pietila, 1988) in hockey and these injuries were found to be only 3rd behind stick contact and player contact (Tegner & R., 1991). Statistics like these highlight the importance of investigating further into the domain of overuse injuries. In Survey 2 53.63% of respondents stated that overuse injuries occurred with their players.

It is well known that hockey players use both their aerobic and anaerobic systems to supply energy to their bodies. Changing acceleration, turning, shooting, and checking all contribute to the large energy expenditure of hockey players (Green, Bishop, Houston, & al., 1976). All of these fine-tuned skills place a lot of stress on the body and contribute to the possibilities of injury. All the changes of speed in a game mixed together with the unstable surface (ice) that it is played on and therefore the dynamic stability needed by hockey players are all factors that increase the risk of musculoligamentous and musculotendinous injuries in players (Sim, Simonet, Melton, & al., 1987). These are the types of injuries one would see due to overuse. Strains are a very popular injury in hockey and often are a result of overuse. Strains of the groin, adductors, neck, rotator cuff, and lower back muscles are very prominent due to the skating motion and posture of

players (Kuzuhara, Mase, & Shimamoto, 2009). These were all common injuries mentioned in Survey 2 by the physiotherapists, AT's, physicians, and strength and conditioning coaches. A strain is a common overuse injury, however often one injury can lead to another, and/or the way the muscles are interacting with each other due to tightness can result in an injury of another body part. This, along with all of the contact in ice hockey can potentially be one of the reasons there are so many MCL injuries. One study found that MCL injuries were the 2nd most common injuries (Grant, Bedi, Kurz, Bancroft, & Miller, 2013), and another found that MCL tears were the most common severe injury (Lorentzon, Wedren, & Pietila, 1988). Though many are a result of contact/trauma, it is credible to speculate that muscle tightness around the knee (quadriceps, hamstrings, adductors, IT band) could also contribute to the injury. Survey 2 respondents had 55.17% stating they strongly agreed or agreed that muscle tightness is a result of overuse in players and 56.52% stated they believe certain players on their roster get too much playing time throughout the season.

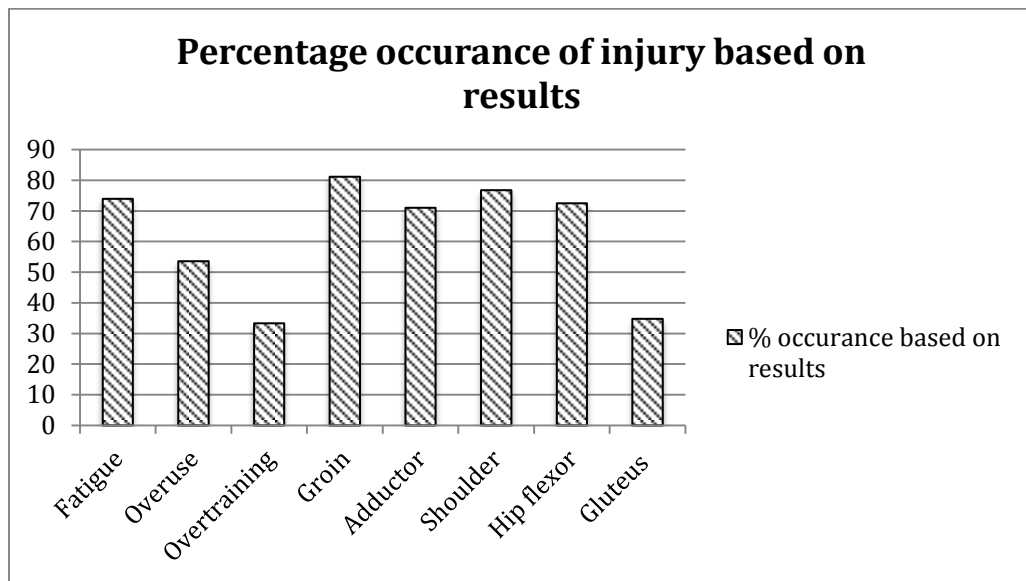


Chart 1. Representation of the occurrence of each of these injuries based on all the responses to survey 2.

It is interesting to note not only which injuries are common, but also at what point in a game they occur. A common trend found in many studies was that the incidence of injury was greater in the 3rd period or at the end of periods. It was found that the injury rate in the first two periods was 75 per 1000 hours and then increased to 135 per 1000

hours in the third (Stuart & Smith, 1995). There is speculation that a player who is fatigued is more likely to be vulnerable to injury due to their body's inability to either brace itself or even by putting themselves in more detrimental positions (Grant, Bedi, Kurz, Bancroft, & Miller, 2013). Trends like these that help determine when players are most injured are important to investigate. The correlation between the injuries occurring late in the game and fatigue/overuse is likely prominent.

Due to findings of fatigue-related injuries, and overuse injuries these concepts will be discussed further. Overuse injuries were classified as injuries with "insidious and gradually increasing intensity of discomfort but no obvious trauma" (Lorentzon, Wedren, & Pietila, 1988). Meaning they do not happen right away and don't necessarily seem to have a reason for occurring, but in hockey it is the wear and tear and physical demands on the human body that cause them. Fatigue is quite a broad concept and can affect many aspects of a player and it can be seen in both athletes and non-athletes. In hockey players there are many reasons why fatigue may occur in an individual. It was found that the aerobic and anaerobic demands of hockey are one of these reasons (Smith, Stuart, Wiese-Bjornstal, & al., 1997). Another reason for fatigue is that athletes are now playing the game 12 months a year because of specialization. Hockey used to be a seasonal sport in the past. This results in the body experiencing chronic fatigue because players never experience the rest from the physically taxing requirements of hockey (Smith, Stuart, Wiese-Bjornstal, & al., 1997). This fatigue of the body is often a cause of injuries.

When a player is fatigued, they change the way they play and the decisions they make. Both of which can lead to injury. A biomechanical evaluation of skating technique was done and showed that there was a decrease in stride effectiveness when players are fatigued (Molsa, Airaksinen, Nasman, & Torstila, 1997). When a player changes their stride they become more prone to injuries such as strains and ligament sprains. It was also found that fatigued muscles were less able to absorb energy before reaching that point of muscle stretch that caused injuries (Molsa, Airaksinen, Nasman, & Torstila, 1997). The maximum isometric force of muscles declines with fatigue, shortening velocity is reduced, and the time course of relaxation slows (Allen, Lamb, & Westerblad, 2008). This all results in muscles being more easily injured and reacting more slowly to the

quick movements and changes of direction of the game. Overtraining can cause this fatigue as well as mental fatigue. It was found that even mental fatigue (measured by the Incredibly Short Profile of Mood States) significantly predicted high school hockey injuries (Smith, Stuart, Wiese-Bjornstal, & al., 1997). Put together, the physical and mental fatigue of athletes can be a big risk of injury and they are often a result of overtraining and the player doing too much. Our Survey 2 showed that 73.91% of respondents said that their players experience fatigue, and 33.33% said overtraining is also an issue with their players.

Since there is a correlation between the amounts of game exposure and overall activity/training levels of hockey players, it could be very helpful to track how much they actually are playing. There are roughly 20 players on the bench in most high level (greater than AA level) hockey games, however it is important to note that the time each of them actually spends on the ice varies greatly from player to player. Not only are there forward lines and defense pairs, but also there are power play units and penalty killers. All of these differentiations result in certain players being on the ice much more than others. Some game situations are also much more physically taxing than others and therefore players on for those situations will be taxed even more physically.

Time On Ice (TOI) is a statistic that is calculated in high levels of competitive hockey. It is the amount of game time that each player is on the ice for and playing. Generally the stars on each team get the most playing time. The first two forward lines and the top 2-4 defense will often get more TOI than the rest of the team. An example of the varying ice-time was that a study (Bantam level which is young teens) found the playing time ranging from a mere 16 seconds to 28.3 minutes in a game and shifts ranging on average from 5 to 18 (Smith, Stuart, Wiese-Bjornstal, & al., 1997). This is commonly seen at even more competitive levels such as junior, semi-pro, and professional.

TOI is most often heard or seen in the media and to many it is a demonstration of which players are the most valuable to their teams. However, TOI is much more valuable than just being another statistic that interests fans, players, and coaches. It is also an

important piece of information that can help the coaching staff, medical staff, and strength coaches. Survey 2 yielded 97.1% of respondents having the opinion that time on ice is moderately important to very important. The overuse injuries discussed above are often a result of fatigue or returning from previous injury at an intensity that is too great, both of which can be minimized and better controlled if the team's staff is aware of exactly how much their players are exerting themselves. In a study monitoring TOI it was found that factors such as playing the power play, penalty kill, or regular shifts contributed to fatigue and that the players in the high playing time group were most likely to be injured (Smith, Stuart, Wiese-Bjornstal, & al., 1997).

Likely the cause of this relationship is muscle tightness being greater in the higher playing time group. Muscle tightness was found to have a significant correlation with injury in male hockey players (Murphy, Connolly, & Beynnon, 2003). This same article stated that 4 other studies found the same correlation between muscle tightness and injury. TOI can help monitor the playing time of each player and therefore give coaches an idea of who may be tired, who he should put on for energy filled situations, but also it can help coaches make sure they do not overplay and burn-out their top players. In situations where a player may be under-performing the coach could look at the amount of TOI they have played and see if they are being overworked and simply on so much that they cannot recover. In Survey 1, 6/16 players stated they feel they sometimes get too much ice time, 3/16 said they think they've been injured as a result of too much ice time, and 10/16 say they've wished their coaches knew what their Time On Ice was so that they'd better understand their fatigue. Team doctors can also use TOI to help explain injuries that occurred for "no apparent reason". It can be another additional reason why a player's injury could have occurred.

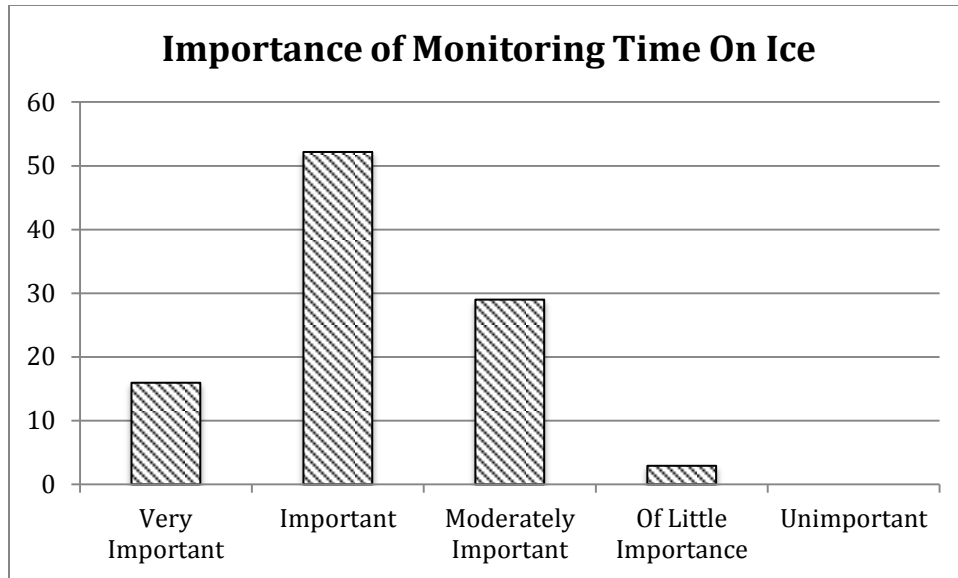


Chart 2. Opinions of the responses to survey 2 regarding TOI importance.

In addition to helping with injury reduction, TOI could also be useful in helping with appropriate return from injury. 55% of Survey 2 respondents agreed TOI shift data could be used to help players return from injury (30.43 were unsure, and 14.5 said it would not). It is common for athletes to re-injure themselves in the same place when returning to play due to an incomplete recovery and/or a return to play that was not gradual enough. Seven studies found that previous injury was a risk factor for sustaining subsequent injury due to proprioceptive defects, muscle strength impairments and imbalance, persistent ligamentous laxity, diminished muscle flexibility and joint movement, and scar tissue (Murphy, Connolly, & Beynon, 2003). A more gradual return to play could be carefully monitored by coaches and medical staff through the knowledge of the player’s TOI statistics. This could enable a safer return to play and decrease the probability of re-injury and over-taxing the returning player.

Finally knowing the TOI could also help strength and conditioning coaches create more individualized programs. It was found in a study that defensemen play 21.1% more minutes than forwards due to 26.1% more shifts and a 37.1% shorter recovery period (Green, Bishop, Houston, & al., 1976). This being said, forwards generally play at a higher intensity than other players. It was found that forwards have a greater aerobic powers than defense or goalies and that defense need greater absolute strength (Burr,

Roni, Joseph, & al., 2008). Each position has varying physical demands on the body. Total TOI within each of these positions can help strength and conditioning coaches create programs for their players that are individually geared to their needs. A defenseman who plays an offensive style but for the amount of minutes the average defenseman would play, could benefit from a different program than your average stay-at-home defenseman. The cool downs of players who are playing more minutes will need to be more lengthy and contain different exercises than those who did not play very much. Yet again 55% of respondents from Survey 2 agreed that players should have individual cool downs. Those whose muscles have been taxed to a greater extent will require a longer recovery time and more fuel/hydration during and after performing.

Overall it is clear that there are many reasons why TOI could be a beneficial statistic. 14 out of 20 players in Survey 1 stated they think knowing TOI is important and as previously mentioned in Survey 2 97.1% think it is moderately important to very important to monitor TOI. Better monitoring playing time could prevent overuse and fatigue in players. It could also be used to make connections with results from the ISPOMS in relation to a player's fatigue. Preventing those mid-season slumps resulting from exhaustion and re-occurring injuries could all be helped through the tracking of players' TOI. Players' training programs throughout the year could become even more finely tapered to the individual by adjusting it according to their average TOI so as to make sure they are getting the appropriate amount of activity and rest. Injury is so prominent in Ice Hockey that any statistic that could help decrease incidence rate could be very welcome to coaches and players alike.

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