

Concussions are a top-of-mind issue in hockey

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David Pearsall, tests a helmet at the McGill Ice Hockey Research Group's lab.
Photo: Owen Egan.

When Montreal Canadiens forward Max Pacioretty fell awkwardly into the boards in the first period of a 4-1 Canadiens win in Florida on April 5, Habs fans held their collective breath.

Heading into the playoffs, the team could ill-afford to lose its top scorer for an extended period of time.

But when a noticeably groggy Pacioretty, the team's top goal-scorer, was helped off the ice and the replay showed his head slamming into the end boards after the check, people and pundits started uttering what has become one of the most ominous words in sports: Concussion.

"Concussions are becoming a bigger and bigger part of sports – especially contact sports like football and hockey," says David Pearsall, Co-Director of the McGill Ice Hockey Research Group and an expert in biomechanics. "Athletes are getting bigger, faster and stronger and the collisions are becoming increasingly violent. While helmet design has become more sophisticated over the years, nothing can guard against [concussion](#) 100 per cent."

This was backed up at the end of March when a study out of Virginia Tech (VT) suggested that most hockey [helmets](#) offer little protection against concussions. In fact, the study gave the majority of the 32 brands of helmets it tested a failing grade, with only one helmet getting three of a possible five stars in the VT scale. The rest of the helmets received two stars or less, with nine brands getting zero stars and a "not recommended ranking."

Bigger not necessarily better

Pearsall, who has been studying hockey helmet design for 20 years, says the VT research, though timely, may be oversimplifying a very complex issue somewhat. "The Virginia group is using a fairly standard but

simplified rating scale that, ideally, should be multi-dimensional," he says. "You have to take into account all sorts of competing factors like functionality; fit; area coverage and a helmet's ability not to obstruct visual and auditory cues. These other factors aren't as obvious as the greatest priority – to protect – but they still are factors."

For example, Pearsall continues, one of the suggestions coming out of VT is that helmets should be bigger. While bigger generally will offer better protection against linear impact (a head-on blow, as in a car accident, in which much of the damage occurs when the brain slams into the front of the skull on initial impact and then snaps back), it may actually increase the risk of sustaining injuries due to rotational forces.

These types of collisions, in which a sudden blow to the side of the head results in a rapid turning of the head or neck, can stretch and even shear brain tissue. The injury resulting from rotational force is most prominent at the juncture between grey and white matter i.e., where neurons and axons from other neurons meet.

"Yes, bigger helmets will be better at absorbing linear forces," says Pearsall, "but they could also amplify rotational acceleration and make it worse. If your helmet is sticking out more and you are hit at an off angle, that will torque your head even more. It is the difference between a small wrench and a big wrench – torque is an issue that can't be trivialized."

Snug but not too snug

Fit is another important factor. Part of the problem, says Pearsall, is that helmet manufacturers don't take into consideration that people have different shaped heads. "Helmets are designed in a very generic way. But not everyone's head shape is the same," he says. "This can create cavities or gaps in one area or another."

And while there are some groups looking at incorporating football-style inflatable bladders in hockey helmets to improve the fit, it doesn't seem to be a development that is gaining much momentum. "Most hockey helmets are padded with vinyl nitrile or expanded polypropylene foam liners. Some people are looking at using the air-type bladders from football but they haven't really taken off," says Pearsall. "Part of the problem is you still want the helmet to have a certain degree of give so that it has the ability to pivot a little bit, otherwise you are going to rip your scalp off."

He says he's seen some interesting design work that incorporates several hard shells into one, kind of a helmet-within-a-helmet. "The premise is to have an outer layer and inner layer that can deform and deal with some of the torque and rotational acceleration issues," he says. "If you can make big impacts stretch a bit longer in time, the acceleration values get much lower which is more tolerable for the [brain tissue](#)."

Secondhand helmets not all they're cracked up to be

Product wear is one issue that most pros – who have their equipment repaired and upgraded regularly – don't have to worry about. Not so true of Canada's thousands of amateur players who regularly strap on used equipment bought at secondhand sports stores or handed down from older siblings. While playing with used shin pads isn't cause for concern, entrusting your child's health to an aging helmet can have serious repercussions.

Pearsall has studied the effects of time on hockey helmets, literally storing various helmets for over a decade to see what – if anything – would happen. "We just finished a study with helmets sitting on a shelf for 10 years and we found that up to five years the helmets were very stable," he says. "But I was surprised at the big changes between years 6 and 10 – especially when it comes to adhesives. Glues start to dry out

and foam starts to change."

Based largely on these findings, the Canadian Standards Agency and the Hockey Equipment Certification Council have now imposed a five-year limit on the lifetime of a helmet. After five years all helmets, even those that have done nothing but collect dust on a shelf, will no longer be deemed safe.

And, of course, one of the biggest variables in helmet safety is the user. While younger amateur hockey players are usually well strapped into protective gear from head to toe, the pros are often a little more lax. "There is definitely a more cavalier attitude among many NHL players," says Pearsall. "Do cages and visors help protect players? Of course they do, but most NHLers play without them. And how many times have you seen a player's helmet be dislodged after a hit because their chinstrap is too loose?"

"Not only are they putting themselves at risk, they are also sending mixed messages to the young players who emulate them."

Provided by McGill University

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