



BELOW Matt Neal's BTCC title hopes were ended when he was diagnosed with concussion following this Brands shunt, keeping him out of the day's final race

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BIG BANG THEORY

Concussion injuries are often dismissed as 'a bang on the head' but are becoming a very real concern in motorsport. **Andrew Charman** learns that accepting the seriousness of such injuries is as big an issue as finding a foolproof method to diagnose them

THE subject of head injuries in motorsport has assumed more prominence in recent times, highlighted by high-profile incidences in single-seater racing.

Formula 1 driver Felipe Massa missed eight races of the 2009 season after being hit on the helmet by a spring from another car at the Hungarian GP and sustaining initially life-threatening injuries, while in the US IndyCar driver Justin Wilson sadly succumbed to injuries sustained when his helmet was hit by debris from another car at Pocono in 2015. As this is written both series are testing cockpit protection devices, the controversial Halo and Aeroscreen, with a view to mandating them in the near future.

According to medical staff throughout the sport, however, there is a far greater, and growing incidence of head injuries occurring, a trend that needs to be taken much more seriously, particularly by

competitors, than is currently the case. These injuries are concussions.

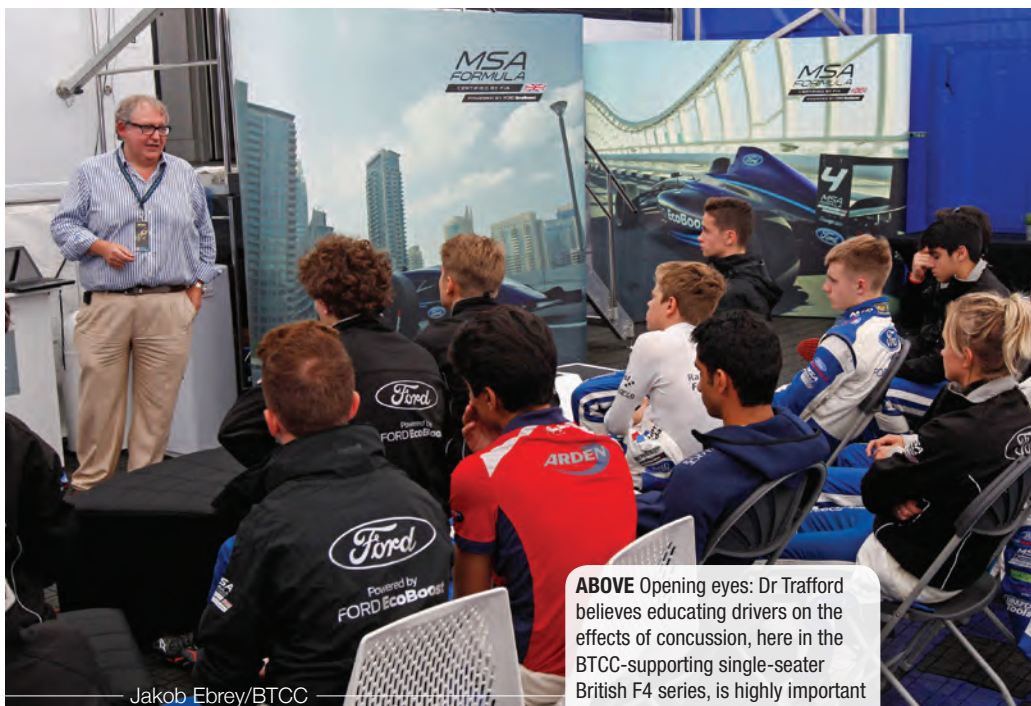
Many drivers and those around them dismiss concussion as merely 'a bang on the head'. But Doctor Paul Trafford, Medical Director to the British Touring Car Championship for 26 years and today a leading figure in motorsport medical safety, argues that they are much more than that.

"One way of classifying traumatic brain injuries is as mild, moderate, or severe, and a concussion is a brain injury, usually at the mild end," Dr Trafford says. "The phrase ought to be thrown away, however, because people don't consider concussion as an injury to the brain – they say "he's fine, a bit of a bang on the head, a bit concussed, but he'll be okay."

The definition of concussion is a chemical change in the brain as a result of some insult to it, principally through rotational forces. While there is no bleed into the brain, it can be described as fibres being torn releasing chemicals. "It's not defined by symptoms such as a headache, or loss of vision, or being grumpy, it's a chemical imbalance in the brain – the symptoms can vary," says Dr Trafford.

A NEW ISSUE

Several factors have contributed to concussion perhaps not being given the prominence it requires. To begin with, Dr Trafford admits that such injuries have only recently become commonplace in



ABOVE Opening eyes: Dr Trafford believes educating drivers on the effects of concussion, here in the BTCC-supporting single-seater British F4 series, is highly important

Jakob Ebrey/BTCC

motorsport: "I've chased hundreds of races in a medical car and you would stop at an accident and go over to the driver and they would either be injured or they would be all right. Now we are arriving and finding drivers bursting into tears, who can't remember who they are, or what's going on, and they get quite distressed."

A prime example of how concussion has moved up the agenda was seen during the final British Touring Car Championship meeting of 2016 at Brands Hatch in October, during which Dr Trafford suspended four drivers from racing with such injuries, in the process ending Honda BTCC driver Matt Neal's championship bid. In America, NASCAR's most popular driver Dale Earnhardt Jr has missed half the 2016 season with concussion-related injuries sustained as a result of two crashes of a level the sport considers commonplace and unremarkable.

Motorsport medical personnel are now discussing concussion far more frequently – the subject was again on the agenda for the FIA's biannual medical conference in Vienna in December. The discussions are concluding

“When you use the phrase ‘brain injury’ they take it a bit more seriously”

that the rise in such injuries could be as the result of safety advances – that introduction of such measures as better seat design, the HANS (head and neck restraint system) Device and such like, may have resulted in drivers escaping from accidents that would previously have caused serious head injuries, with a concussion instead.

"To be honest we don't know, it's early days for studies into concussion, but we do seem to have fewer serious head injuries these days," Dr Trafford says.

Currently there is no proven, fail-safe way to diagnose a concussion injury, but the consequences of not properly diagnosing or treating the symptom could be particularly severe in motorsport. "If you play rugby with a concussion, you don't feel right, but the worst you are going to do is kill yourself," reasons Dr Trafford. "In any sport with mechanical elements such as motor racing there is a very real risk that not only

Learning lessons from F1

A FACTOR that will be taken into account by the ongoing research into concussion is that such injuries are virtually unknown in single-seater racing, whether Formula 1 with its 190 mph impacts or at national level such as the Formula 4 series that supports the British Touring Car Championship.

Dr Trafford believes a number of factors could be contributing to this, principally the way that the driver is held in the car. "The headrest has more foam on it, you are held more precisely in the cockpit than in a closed car," he says.

"Also the head protection, the 'ears' of the seat are sited much closer together in a single-seater. Interestingly in conversation with Tom Gideon, Director of Safety Initiatives for NASCAR, we've learnt that they have moved the seat ears closer together, almost pushing the helmet backwards so that the head is better held."

This is all very well for NASCAR, where drivers do not need to look around them as they have an external spotter radioing instructions into their helmet – in Touring Cars all-round vision is more essential. "That's the big difficulty, so one of the areas we are looking at is whether we could introduce more foam to the seat," he says. "Today's seats are more solid and rigid than previously – so you are not absorbing that energy. Whether you are instead transmitting it through the seat, we don't currently know.

"[BTCC driver] Hunter Abbott was telling me that he added padding to his HANS device, as he was aware when he had his big accident at Snetterton in August that his helmet went back and hit the HANS – but it's all theory.

"The problem is we can to some extent dial out the movement of the head by holding it rigidly, but the brain is like a jelly inside the hard shell of the skull. Even if you hold the skull rigidly, if you stop suddenly your brain will still be sloshing around, you can't dial it out completely." **BT**



will you injure or kill yourself, but also fellow competitors, spectators, officials... So that's why in motor racing it is now being taken more seriously."

A survey on concussion carried out across the sport in 2015 by the FIA's Auto+Medical, a safety journal started by Dr Trafford, produced some dramatic conclusions. Of drivers who admitted to suffering a concussive episode, only half had discussed it with a doctor, though 70 per cent

admitted to not feeling normal when first returning to the sport after the incident. Of those who responded to the competitor survey, 45 per cent admitted suffering concussion-related symptoms following an accident, principally dizziness, headaches and confusion, but only 36 per cent of these sought medical advice as a result.

Because concussion does not appear to be a physical injury, it is difficult to get across to competitors and those around them ▶

how serious it is. "If you have broken your leg or such like, or you have a bandage on, people can see you have an injury, but with concussion, people think 'what's wrong with him, he looks perfectly healthy,'" Dr Trafford says.

This has been particularly noticeable in the case of Dale Earnhardt Jr, who while out of the cockpit of his NASCAR car has been attending the race meetings, holding press conferences discussing his injuries and helping with the TV commentary, prompting fans to wonder why he cannot race. "The problem is people don't understand that when racing you have to really concentrate to put that car where it needs to be," says Dr Trafford. "If you can't do it right, firstly you won't be very good and will be at the back, getting in the way of the other drivers, and you'll be liable to injure yourself or someone else."

EFFECTIVE DIAGNOSIS

Education on the effects of concussion is important, but equally so is finding a way to effectively diagnose the symptoms. Dr Trafford points out that concussion can range across different symptoms, for example hearing, balance, sight. "The driver can get headaches, feel grumpy, not

BELOW NASCAR's Dale Earnhardt Jr missed the final 18 races of the Sprint Cup season after experiencing concussion-like symptoms. He previously missed races following a pair of crashes in 2012, and is believed to have had several other concussions related to racing incidents

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sleep so well, but all the symptoms are a bit woolly. It's not like 'I have a pain here, it moves there,' instead it's 'I am not quite right, I'm not sleeping properly, shouting at my family,' so it's quite difficult for us to even diagnose."

He adds that diagnosis is far easier with a person one knows: "if I see you every week and suddenly one day you are not quite right, I can tell. But if I've never met you before it's more difficult to tell whether that's normal behaviour.

"Matt (Neal) was far from right after his accident, he got himself out but he was a bit dizzy and that persisted. When Andrew Jordan had a crash at Snetterton in 2014 it was the kind of typical incident in which

the team's mechanics could have the car ready to go again in a very short time, but Andrew couldn't remember the pin number for his phone to call his dad. These are the alarm signs."

So medical staff are now calling for the development of guidelines to aid the diagnosis of concussion. Over the past season Britain's motorsport governing body the MSA has introduced regulations to suspend the licence of those with concussion and the BTCC has been trialling a similar system to that used in such sports as football and horse racing, which employs a test known as the SCAT – Serious Concussion Assessment Tool.

Effectively SCAT tests the level of a person's ▶



Jakob Ebrey/BTCC

RIGHT & INSET On the sidelines: Relegating a driver to the role of spectator when he appears to be fine, such as Andrew Jordan following his BTCC crash at Snetterton in 2014 (inset), is a tough but necessary call for medical staff



PSP Images

BELOW NASCAR, like Touring Cars, provides dramatic accidents from which drivers usually walk away, making both series prime environments in which to study ways of improving protection



Getty Images/NASCAR

consciousness based on their responses to questions, which must require use of short-term memory – a typical one in football is “which team scored the last goal?” While this is irrelevant to motorsport, specialist questions can be developed to achieve the same result.

“From 2017 we will be using a system called ImPACT, which is a computer-based psychometric test, to assess competitors who we think may be concussed – we have already undertaken baseline tests on all BTCC competitors and many within all the support championships,” Dr Trafford adds.

EVIDENCE ON CAMERA

Concussion can occur without causing loss of consciousness, but if a driver is knocked unconscious in an accident medical staff need to know, and this is being aided by the rise of in-car cameras. Often it is not apparent that a driver has been briefly knocked out in a crash as they usually come round by the time marshals reach the car.

“All the cars have cameras in now, and while they usually point forward, if you look in the rear-view mirror you can see the driver’s head, their face,” says Dr Trafford. “In a crash their head goes down, they are unconscious for perhaps five seconds, and by the time the accident stops they are coming round, the marshals get there, or us if it’s the first lap, and they are going, ‘I’m fine, I’m fine.’

“Nobody knows they’ve been knocked out because nobody witnesses it, unlike in rugby where you are watching from the side so you can see because they fall on the ground.”

The sport of rugby now employs a video surveillance system, experts watching a TV screen looking solely for potential concussion incidences that can be played back to doctors, and motorsport is looking to follow suit. From 2017 the BTCC is hoping to run a trial with cameras mounted in the cockpit and pointing directly at the driver’s head, purely to observe their reaction in an accident. And this will form part of a growing drive to gather more information about concussion in the sport.

“We have an advantage in Touring Cars in that bolting a camera onto the roll cage won’t affect anything because all the cars are of the same weight,” notes Dr Trafford. “Not all of the drivers wear full-face helmets, and even if they do they often race with the visors up. So the eyes are visible, which is what you need to see, unlike Formula 1 where all you are looking at is the helmet



ABOVE Looking for answers: BTCC Medical Director Dr Paul Trafford is in the forefront of research to learn more about concussion injuries

which isn’t of much use.”

Matt Neal was also wearing ear accelerometers at the time of his crash and the data from these will be analysed along with in-car and external footage from the incident. Like many before him Dr Trafford describes the sport as a very good research tool: “You not only see incidents first-hand as you are there watching, but you are at such an incident immediately, and you can record all the data you need.”

The research will continue using the live environment of the BTCC, with the results being passed on to the wider motorsport arena. Dr Trafford is working closely with Professor Peter Hutchinson, chief medical officer at Silverstone, also the head of neurosurgery at Cambridge University. He has available a new MRI scanner, believed to be the only one of its type in the UK, that can measure the level of chemical imbalance in the brain. Where there is any doubt, all drivers removed from racing due to concussion injuries must be cleared by Professor Hutchinson before returning to competition, and the MRI scan forms part of that process, adding to the information gained.

Dr Trafford would also like to see motorsport authorities putting more investment into information for drivers: “We want to try and raise awareness of concussion amongst competitors and to that end we need some sort of education programme – we are pushing very hard for the FIA and the MSA to get behind us on that.

“Already a great deal of money is invested in making drivers aware of what not to do, such as taking drugs, but frankly concussion ▶



Jakob Ebrey/BTCC

ABOVE Roll protection: Drivers are becoming aware of the need for further protection. Hunter Abbott added extra foam to his HANS device before his dramatic accident at Snetterton in August 2016

is a far more common and enduring thing than drug taking – I think we should channel money into alerting drivers to what the symptoms are, what the consequences are, explaining that the most likely outcome is that they will get better within a few days, but they have to follow some guidelines and take it really seriously.

“We also need to educate the medical people involved in motorsport to look for concussion, what advice to give and understand how competitors should be reintegrated after a concussion.

“You have to respect that your body needs time to heal. You haven’t had a bleed into the brain, but it’s been bounced around, torn a few of its fibres and a few chemicals have been released. We do say to drivers now, ‘It’s concussion, a mild form of brain injury,’ because when you use the phrase brain injury they take it a bit more seriously.”

Dr Trafford sums up the concussion issue as partly about educating people to know

the problem is there, educating doctors and paramedics to know that concussion is a real thing and the driver needs taking out of competition, and finally about trying to gather information as a research tool. The latter can determine whether prevention can be improved, and the incidence of concussion predicted, determining at what point a threshold is triggered where such an injury will be likely.

“If we can work out what’s causing the concussion, then maybe we can start to dial it out – maybe through seat design, helmet design, things like that. But it’s quite a road to travel and it will involve organisations such as the FIA’s research arm, the Global Institute.

“I’m not an engineer or a research scientist, but we know enough to collect the data, and we are trying to collect enough to say there is a problem here, we’re seeing this and we didn’t see it before, and this is the level of impact we’re seeing it at.” **RT**



Jakob Ebrey/BTCC

ABOVE The wider use of in-car cameras, and the tendency of BTCC drivers to race without visors down, is helping medical teams to look for evidence of concussion injuries

Overcoming opinion

JUST as this feature was completed an incident in the NASCAR Sprint Cup Series demonstrated the difficulty medical staff face in convincing drivers of the potential serious nature of concussion injuries.

Driver Matt DiBenedetto was diagnosed with a concussion following a crash in the second-division Xfinity Series race at Texas Speedway in November. Having exited the car himself DiBenedetto was prevented from racing in the following day’s Sprint Cup Series event. Instead of resting as recommended, the driver sat on the pit box during the race, and described himself as “frustrated but not angry,” at NASCAR.

DiBenedetto also expressed his frustrations on social media, saying that he felt fine, which prompted 2013 Sprint Cup champion Brad Keselowski to question why he was being kept out of the car. Keselowski has been a persistent critic of concussion protocols in the past, questioning why doctors should be able to make such decisions when in his opinion the driver is in the best position to decide whether they are fit to race.

Speaking to NBC Sports after the DiBenedetto incident, Keselowski said that concussion remains too much of a grey area: “I’m very fortunate to make a living as a driver in this sport, so are a lot of others, and that can be very easily taken away from you by someone who wants to make a conservative decision.”

Dr Trafford believes this incident demonstrates why there is a need for education and protocols in place and more research to allow more educated decisions to be made. “Drivers will nearly always tell you they are okay,” he says. “They have to learn to be honest with us and realise doctors have no interest in stopping them racing – it would be more helpful if drivers got behind the research to help us find out what’s going on rather than be critical about decisions to protect them and their fellow competitors.” **RT**

