Long Term Effects of Concussions on the Brain

Many people have been in accidents or played sports in which they’ve gotten a concussion. A concussion is considered the most common type of traumatic brain injury, and is caused by a blow (hit) to the head and/or a violent shaking of the head. Those that experience a concussion may experience an array of symptoms including impaired cognition, a decline in fine motor skills, and in some cases neurodegeneration.

Fortunately most people with concussions seek out proper medical help and are able to make a full recovery. To determine if the person’s brain has healed after being concussed, a panel of tests can be administered including: brain scans, neurological evaluations, and cognitive evaluations. Although recovery is possible after a minor concussion, there are some individuals (e.g. NFL athletes) that experience many concussions, leading to detrimental long-term effects.

Factors that influence the long-term effects of concussions

There are several factors that are likely to dictate the degree and severity to which you experience long-term effects from one or multiple concussions. These include: the severity of the concussion(s) endured, number of total concussions, frequency by which the concussions occurred, as well as individual factors such as your particular anatomical structure and genetics.

1. Severity of concussion

According to the Colorado Medical Society, there are different severities of concussions. Lower grades of concussions are associated with less detrimental long-term effects as well as lessened severity should any long-term effects occur. While it is certainly possible for even a Grade 1 concussion to result in some sort of long-term impairment, the impairment is much less likely than those enduring Grade 2 or Grade 3 concussions. If you experience a Grade 3A or 3B concussion, you will have likely end up with some long-term damage.

- **Grade 1**: This concussion is mostly characterized by confusion and is thought of as being the least severe. If it occurs just once, the person is thought to recover within 15 minutes. However, for each successive concussion of this grade, it can take up to a full week to recover.

- **Grade 2**: This concussion is more severe and a person will generally need at least a week to recover. If multiple “grade 2” concussions occur, a person will likely need at least 2 weeks and physician approval before returning to any type of sports.

- **Grade 3A**: If you endure a Grade 3A concussion, you’d be knocked out for a few seconds. The damage occurring in this type of concussion is more extreme, and will generally keep you from playing sports for up to a full 30 days (month). Should you experience multiple concussions of this severity, any secondary concussions will take at least 6 months to heal.

- **Grade 3B**: This is the most severe type of concussion in which you’d be unconscious for minutes. Just one of these can keep you from playing sports for 6 months and if you experience a subsequent concussion of this magnitude, you’d be out for a minimum of 12 months from sports.

2. Location of the concussion
Another factor that will play a role in determining the long-term effects that you experience is the location in which you were hit. Each brain region tends to correspond with a different aspect of functioning. If you get hit on the right side of your head, you’ll likely experience different effects than you would if you got hit in the back of your head or the front or your head.

If you understand the way the brain works in relation to where you were concussed, you may be able to come up with some reasons as to why you’re experiencing particular long-term effects. It should also be known that if you experience multiple concussions to the same area of the brain, it may amplify any existing impairments and effects. When multiple concussions ensue, different effects occur due to the different regions they impact.

3. **Number of total concussions**

The number of concussions that you endure is often an important factor of influence in predicting long-term outcomes. Even if you endure just one minor Grade 1 concussion, any subsequent concussion can do serious damage. If you end up with several Grade 1 concussions, the cumulative effect and toll on the brain is very significant. The more concussions you have, the more likely you will be to endure unwanted, and potentially irreversible long-term effects. This is why it is important to make a conscious effort to minimize concussion risk in all circumstances.

4. **Frequency of concussions**

The frequency or rate at which you experience concussions is also an influential factor. If you endure multiple concussions within 1 week, the effects are going to be more extreme than if you were to endure multiple concussions within a longer-term such as 6 months. The time span between your first and secondary concussion is likely to play a role in determining the long-term effects that you experience. Those with longer gaps (of time) between their concussions are thought to have better prognoses than those with shorter gaps.

5. **Individual factors**

It is also important to realize that the long-term effects of concussions are subject to individual variation based on numerous personal factors. These include things like: age at which the concussion was endured, cognitive reserve, recovery efforts, genetics, anatomy, whether the person is taking medications, etc. Someone may experience less long-term impairment simply based on their particular anatomy or genetics. Those that experience concussions at a younger age may experience developmental problems as a result.

As was mentioned, the specific type of long-term effects you end up with as a result of a concussion are highly individualized. One person may end up with more cognitive impairment such as memory and attentional deficits, while another may struggle more with visual processing. Below is a list of some possible long-term effects that you may endure as a result of a concussion.

1. **Cognitive impairment**

Concussions often disrupt various elements of higher-order neurocognition. Among the most common long-term effects from a concussion is cognitive impairment. Cognitive function refers to your ability to acquire, retain, and synthesize information. When your cognitive function becomes impaired, you may struggle with attention, memorization, learning, critical thinking, and reasoning skills.

   - **Attention:** Your attention may be impaired to the point that you’d fit the diagnostic criteria for ADHD (attention-deficit hyperactivity disorder). It may be difficult to stay focused in school or at work, and you
may experience a significant degree of “brain fog.” If you aren’t able to stay focused while reading or attempting to study new material, it could be from your concussion.

- **Learning**: It may become difficult to learn new information and skills after a concussion. The learning impairment may be relatively long-lasting, spanning over a period of years. Some people may have learning difficulties for the rest of their lives as a result of the damage endured from getting concussed.

- **Memory**: All types of memory including: working, short-term, and long-term memory can become disrupted. This can take a toll on your IQ score and ability to hold a conversation with others. Some people feel as if their memory is scrambled and they experience a significant degree of amnesia – even surrounding the event during which they got the concussion.

- **Reasoning**: Another aspect of cognition that may drop is that of reasoning. This ties in with memory and logic, and is the ability to think critically about a situation and make a sound decision. If you find yourself unable to justify behaviors with logic, it could be that your reasoning centers experienced damage.

- **Self-Control**: In some cases, a person may become significantly more impulsive after experiencing a concussion. This is a result of damage to higher-order functions of the brain (e.g. prefrontal cortex) that are responsible for self-control. Even subtle differences in impulse-control may occur over the long-term following concussions.

2. **Sensory processing impairment**

Many people experience sensory impairment following a concussion. Perhaps the most common sense that is affected is that of vision. Some people experience “blurry vision” as a result of damage to the occipital lobe – an area of the brain responsible for processing visual inputs. Others may experience damage to the auditory cortex, which impairs their ability to process sound. Rarely would a person experience changes in tactile, olfactory, and taste inputs.

- **Visual**: One of the more common long-term effects of concussions is that of distorted visual processing. If you were hit on the back of your head (occipital region), this can cause damage to the occipital lobe. This can impede spatial awareness and your ability to successfully navigate within your environment.

- **Auditory**: Within the temporal lobe on the side of your brain lies the auditory cortex. This area is responsible for the processing of sound. If this area becomes damaged as a result of a concussion, you can lose your awareness of certain sounds that you know. It’s not that your hearing becomes damaged, it’s that the area of your brain responsible for making sense of what you hear isn’t correctly functioning. This is sometimes a long-term problem for those with severe concussions.

3. **Abnormal Brain Waves**

Brain waves refer to electrical impulses traveling through the brain. For the brain to perform optimally, a healthy balance of brain waves should show up on an EEG. Individuals that are concussed may display excessive “slow wave” activity, leading them to have difficulties with concentration and dysphoric moods.

As an example, let’s say that the prefrontal cortex suddenly began showing strong theta wave activity following a concussion. This may make a person feel fatigued, spacey, and prone to ADHD-like behavior. Normally, a person’s brain would produce beta waves in the prefrontal region to help them stay alert, focused, and productive at work.

Although neurofeedback may help correct certain brain waves following a concussion, it is certainly not a panacea treatment. Some find that it never is able to correctly adjust the electrical activity in their brain, leading
to (potentially permanent) impairment. Abnormal brain waves can contribute to: mood swings, concentration problems, sleep disorders, etc.

4. Motor Skills Decline

Those who endure concussions may also experience deficits in their motor skills. Most often a person will notice that their “fine motor skills” become impaired and just aren’t what they used to be (prior to the concussion). If you experience difficulties with balance, coordination, and your ability to perform technical movements after your concussion, your motor skills may have become compromised.

- **Fine motor skills**: If your fine motor skills become impaired, you may lose your ability to perform a highly technical movement such as: knitting, juggling, playing the piano, or playing a video game. You may also find that your hand-eye coordination suffers and you can’t seem to figure out why.

- **Gross motor skills**: Although impairment in gross motor skills such as the ability to walk or balance aren’t typically problematic, they still can be affected to an extent. For most people these tend to improve over the long-term unless the brain was severely impacted after the concussion.

5. Communication Problems

A person may experience difficulties with communication and/or speech processing over the long-term. They may have difficulty talking as well as making sense of what they’re told. Some individuals may experience “aphasia,” a condition characterized by an impairment in the understanding of language as well as difficulties with reading and writing. An individual with aphasia may also display inappropriate facial expressions during a conversation.

Generally only very severe concussions with impact to the frontal cortex are thought to cause aphasia. If someone has significant difficulties with communication, it could be that their frontal cortex absorbed a majority of the concussive impact. The greater the severity of damage, the more likely that a person’s ability to effectively communicate and/or write becomes impaired. Fortunately, most people tend to significantly improve within 1 year of the concussion as a result of proper rehabilitation efforts.

6. Emotional Disturbances

As a result of concussions, many people experience frequent mood swings, anxiety, and become depressed. This may be in part due to the fact that damage was incurred on the prefrontal region of the brain, an area that helps us control emotional responses and generate a positive outlook. Some people experience long-term changes in mood and develop psychiatric disorders like major depression and/or anxiety after their concussion.

- **Anger**: A person may become more impulsive and have a more difficult time controlling their emotions. The anger may be a result of damage to a particular region of the brain and/or brain wave activity. If you find yourself lashing out at others and unable to escape perpetual anger, it could have stemmed from the concussion.

- **Anxiety**: Others report severe anxiety after they’re concussed. The anxiety could be due to a shift in brain activity, but may also be a result of impaired cognition. If you could think clearly and were able to learn easily prior to your concussion, but now you have difficulty, it may lead to a significant amount of stress.

- **Depression**: There are various reports of former-NFL players committing suicide as a result of the brain damage they incurred from concussions. This shows that not only can concussions impair cognition,
they can lead to major long-term depression and suicidal thinking. Some people experience concussions and their outlook is never quite the same as it used to be.

7. Neurodegeneration

There is some evidence suggesting that concussions may be associated with development of neurodegenerative disorders like dementia. Although it cannot be stated for a fact that a concussion specifically causes dementia to develop, many scientists have a hunch that it does. Those that endure any form of a traumatic brain injury are at a 26% greater risk for development of dementia than those who don’t.

It is believed that “tau protein” may play a role in influencing the development of neurodegeneration. When a person is concussed, they may experience abnormally high levels of this protein – which leads to a poorer overall recovery. High levels of tau protein are also found among individuals with Alzheimer’s disease. Development of a neurodegenerative disorder is among the worst of long-term effects associated with concussions.

How long do the “long-term” effects of concussions last?

There’s no telling how long the effects of concussions will last for everyone; this answer cannot be generalized. For some individuals, the effects of their concussion will significantly lessen and/or heal within 1 year after the impact. For others, the effects may be permanent and may never improve for the rest of their lives. As was already mentioned, the duration and severity of the long-term effects is subject to significant individual variation.

Some studies have been able to confirm declines in brain performance nearly 6 years after a concussive episode. That said, the studies that noted these declines also mentioned that the differences between those who were concussed and a control group were very minimal. Based on behaviors and external observation, the concussed group was indistinguishable from others.

Does everyone experience long term effects from concussions?

Not everyone experiences long-term effects from concussions, especially if the concussion isn’t very severe and targeted rehabilitation efforts are made. A majority of people who endure multiple concussions will experience some long-term effects, but whether they are consciously aware of these effects is unknown. Although long-term effects may be inevitable in severe concussions, proper rehabilitation can minimize them to the point that they don’t pose major functional impairment.

Recommendations for dealing with long-term effects

If you are dealing with long-term effects of a concussion, it is best to seek professional help. You’ll likely want to continuously monitor the severity of brain damage you’ve endured from the concussion, as well as track any changes and/or improvements over time. Rehabilitation experts may recommend various supplements and/or medications to promote brain health and improve your cognitive function. Some believe that since concussions likely kill brain cells, active efforts to promote neurogenesis (or growth of new brain cells) can provide benefit.

Have you experienced any (unwanted) long-term effects from concussions?

If you have experienced a concussion (or multiple), be sure to share the effects you’ve endured over the long-term, as well as their overall degree of severity. Give a little background on your personal situation and discuss
how long it's been since you've had a concussion. Mention when you first noticed long-term effects and whether they've improved since you first noticed them. If you've gone through a rehabilitation process, discuss whether it was noticeably helpful.

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