

Understanding Brain Injury in Adolescence

**A guide for parents, coaches, educators and
those that work with youth**



Presented by The Sun Life Financial Chair in Adolescent Mental Health

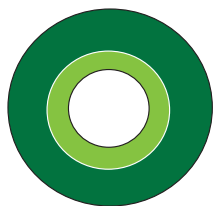
www.teenmentalhealth.org

The Sun Life Financial Chair in Adolescent Mental Health, is a knowledge translation team at the IWK Health Centre and Dalhousie University. The team has been working together with young people, parents, educators and health providers to develop resources and programs that can be used in schools and other educational settings to effectively address youth mental health.

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Created and Written by:

Dr. Stan Kutcher, MD, FRCPC, FCAHS

*Professor of Psychiatry and Sun Life Financial Chair in Adolescent Mental Health
IWK Health Centre, Dalhousie University*

Written by:

Asraa Al-Mosawie, MEd, MSc

*Acquired Brain Injury Program
Capital District Health Authority, Dalhousie University*

Designed and Edited by:

Mitchell Shea

*Communications Coordinator
Sun Life Financial Chair in Adolescent Mental Health*

Reviewed by:

Dr. Joan Backman, Ph.D. R.Psych.

Neuropsychologist, IWK Health Centre

Dr. Anne Cogdon

Executive Director of Primary Health, IWK Health Centre

Paula Dunn, RN

IWK Cerebral Palsy Clinic Coordinator

Dr. Gail Eskes, Ph.D. R.Psych.

*Associate Professor of Psychiatry, Psychology and Medicine (Neurology)
Brain Repair Centre, Dalhousie University*

Dr. Lynn Fenerty, RN

*Neurotrauma & Injury Prevention Research Programs
Division of Neurosurgery, Capital District Health Authority*

Dr. Jeffery S. Kutcher, MD

*Director, Michigan NeuroSport, Department of Neurology,
University of Michigan*

Dr. John LeBlanc, MD, MSc, FRCPC

*Associate Professor, Departments of Pediatrics,
Psychiatry and Community Health and Epidemiology,
IWK Health Centre, Dalhousie University*

Dr. Robert J. McInerney, Ph.D. R.Psych.

Neuropsychologist, IWK Health Centre

Dr. Brigitte Patry, Ph.D. R.Psych.

Neuropsychologist, Capital Health Authority

Kate Randall, MA

Neuropsychologist Resident, IWK Health Centre

Joanne Banfield, RN, BA

*Manager, Trauma Injury Prevention, RBC First Office for Injury
Prevention, Sunnybrook Health Sciences Centre*

Paula Tymchyshn

National Program Coordinator, ThinkFirst

Dr. Charles Tator, PhD, MD

Founder of ThinkFirst, Toronto West Hospital

Dr. James Kissick, MD, CCFP & Dr. Mark Aubry, MD

Ottawa Sports Medicine Centre

Jessica Wishart, Dr. Alan McLuckie,

Justin Dickie, Christina Carew

Sun Life Financial Chair in Adolescent Mental Health

**Joel Maxwell, Emily Atkinson, Karl Yu, Nicole Gabriel,
Taylor Crosby, Kristin Gray, Mina Hashish, Kathleen Gallant,
Elizabeth Ewert, Michael Smith, Marika Forsythe**
Youth Advisory Committee, IWK Health Centre

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Quick fact: Thousands of brain injuries occur in Canada each year; the majority of them occur in youth under the age of 25.

Our brain is the most sophisticated and complex organ in the human body. It controls the way we feel, think, behave, understand, experience and interact with the world around us. It continues to develop well into the adolescent years (13-25 years of age) with many important changes happening during that time. A brain injury sustained at this critical time may have a significant and long-lasting impact on brain development.

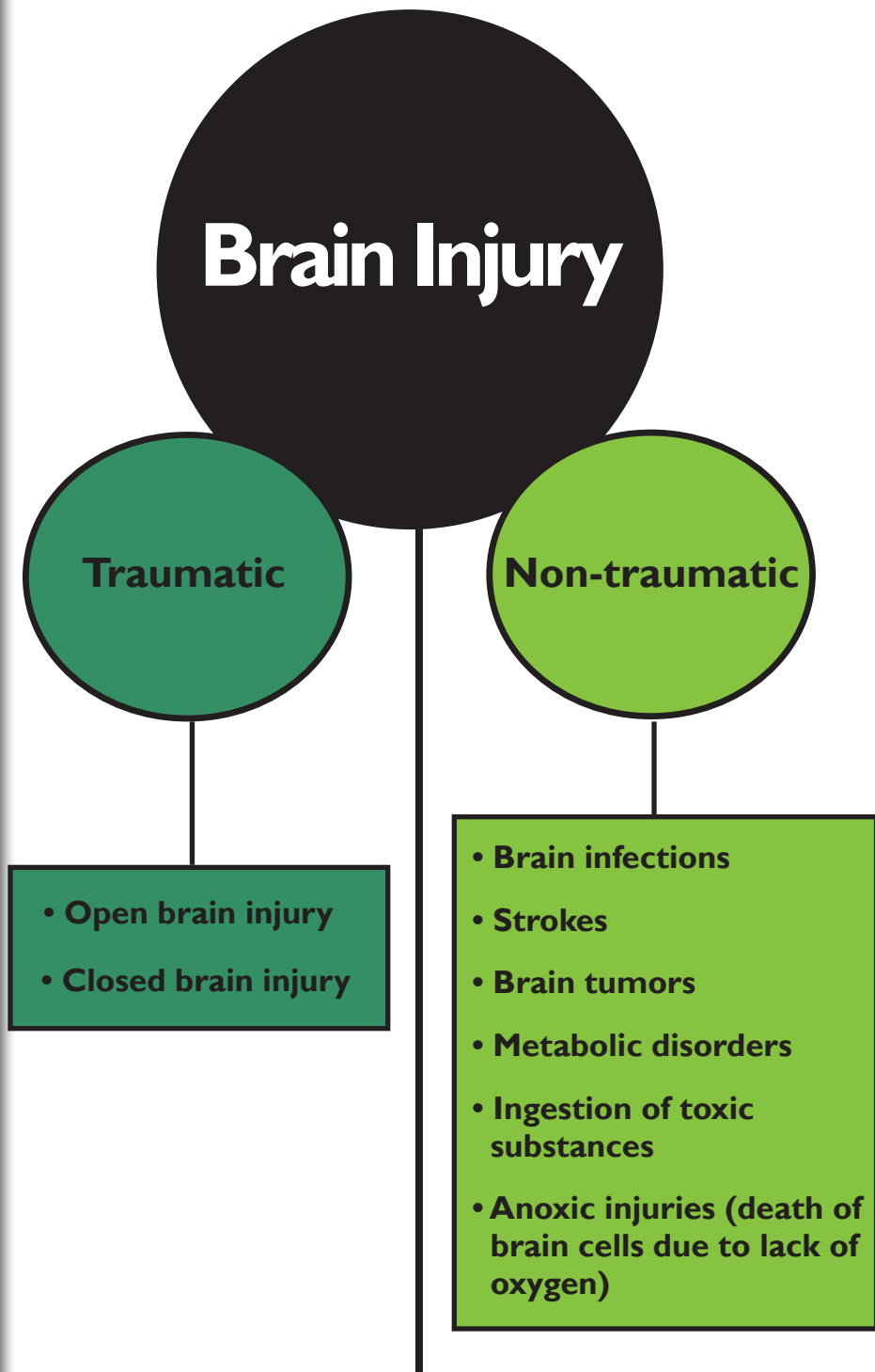
For example, a brain injury may harm, not only the current functioning of the damaged part, but it may also affect how other parts of the brain grow and develop over time.

The extent of brain damage will depend on:

- **The type of injury**
 - Traumatic (open or closed)
 - Non-traumatic
- **The severity of the injury**
 - Mild
 - Moderate
 - Severe
- **Where the damage occurred on the brain**
 - Front
 - Back
 - Left
 - Right

This guide will provide a basic overview on important issues pertaining to brain injury in adolescence. The goal of this guide is to give young people, parents, coaches and other individuals who work with youth:

- A better understanding of what brain injury is in adolescence
- Help you feel more comfortable about talking with your doctor or other health care professionals
- Help adults cope and communicate with youth who suffer from brain injury





Quick fact: Only one in 20 people with traumatic brain injury receive the rehabilitation they require.

Open brain injury

Open brain injury happens when an object penetrates the skull or when the skull is broken. This type of injury is usually quite visible and requires treatment immediately. It can result in:

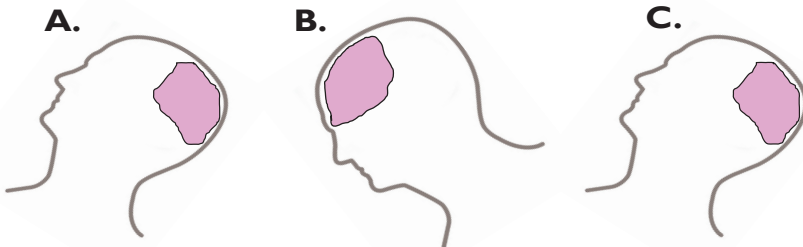


- Seizures
- Paralysis
- Coma
- Death

Closed brain injury

Imagine watching a hockey game and a player is skating up the ice with the puck. The opponent body checks him causing him to fall backward and smacking his head on the ice. This action may have the player to damage their brain in at least two places, even if there was no obvious head injury.

The initial blow to the head causes damage in the back part of the brain where the head first struck the ice (see image A). This type of injury is called a “coup.” Following this, the brain will bounce around in the skull, striking the side opposite to where it first struck (see image B). This is called the “countercoup.” The brain can continue to bounce and strike the skull in different places depending on how severe the initial hit was (see image C).



Quick fact: It is estimated that one-third of youth will obtain a mild traumatic brain injury (concussion) by the time they finish school.



Mild traumatic brain injury

Mild traumatic brain injuries, also known as a concussion, can lead to many problems and since there is no obvious damage to the head, the adolescent, parents or coaches may not realize how serious it may be. This is why it is so important to seek medical attention after a head injury. If the injury did result in brain damage, it's important that immediate treatment be put into place.

Diagnosing a mild traumatic brain injury is usually based on how the youth felt at the time of the injury or shortly after it. The diagnosis can also be determined by a noticeable change in behaviour, emotions or thinking observed by family and friends.

Moderate traumatic brain injury

Moderate traumatic brain injury occurs when the youth is knocked unconscious for longer than just a few moments. Concussion symptoms including behaviour, emotion or thinking changes can last for weeks or months, sometimes longer.

Severe traumatic brain injury

Severe traumatic brain injury is diagnosed when the adolescent has sustained a major head trauma with bleeding, loss of consciousness, coma or skull fractures. This type of injury is much more serious and the effects can be long lasting.

The most important things to remember in these situations are:

- ① Seek immediate medical attention
- ② Keep the injured youth (and yourself) calm, explain to them what has happened and that they will be getting medical attention soon
- ③ Make sure the young person understands what the recommended treatment is and why
- ④ Help the young person follow treatment recommendations
- ⑤ Support the young person's return to usual activities when cleared by a doctor (*see return to play guidelines on page 13*)



Quick fact: Recovery from a concussion may take longer in adolescents compared to adults.

A concussion is a brain injury that is caused by a blow to the head or body that leads to problems with brain function due to brain damage. It can occur without a loss of consciousness and can be caused by what seems to be a mild blow or bump. A concussion can occur in any sport or recreational activity, as a result of a fall, a collision or other mishap.

There are many different symptoms that can appear with a concussion. These include:

- Confusion
- Headache
- Pressure in the head
- Difficulty concentrating
- Difficulty remembering
- Drowsiness
- Neck pain
- Dizziness
- Blurred vision
- Balance problems
- Slurred speech
- Short attention span
- Sensitivity to light
- Sensitivity to noise
- Feeling as though “in a fog”
- Not feeling “right”
- Fatigue or low energy
- Trouble sleeping
- Increased emotionally
- Mood swings
- Irritability
- Sadness or depression
- Nervousness or anxiety
- Loss of consciousness
- Coma
- Paralysis
- Epilepsy
- Feeling slowed down

Remember: Symptoms may appear on their own or in any combination.



Note: Sometimes it can be difficult to recognize the symptoms of a brain injury. Subtle symptoms can conceal serious brain damage. Whatever the degree of brain injury, it's important to seek immediate medical attention. Brain injuries which are not treated or not treated properly can even be fatal.

Quick fact: Any blow to the head, even if it may seem to be harmless, can lead to a concussion. Some symptoms take time to develop and may not appear until later.



Sport Concussion Assessment Tool (SCAT2)

International medical meetings on concussions have resulted in consensus recommendations pertaining to concussion in sport. A useful summary of concussions in sports is found in the Sport Concussion Assessment tool (SCAT2) card. This card is freely available and the “pocket version” (the Pocket SCAT2) is reproduced below. This can be used by coaches or trainers to assess athletes who may have suffered a brain injury. Remember, young people may initially exhibit fewer signs of concussion than adults do. If you suspect that your child/player may have suffered a concussion, **DO NOT ALLOW THEM TO RETURN TO PLAY AND MAKE SURE THEY ARE MEDICALLY ASSESSED AS SOON AS POSSIBLE.**

Pocket SCAT2



Concussion should be suspected in the presence of **any one or more** of the following: symptoms (such as headache), or physical signs (such as unsteadiness), or impaired brain function (e.g. confusion) or abnormal behaviour.

1. Symptoms

Presence of any of the following signs & symptoms may suggest a concussion.

- Loss of consciousness
- Seizure or convulsion
- Amnesia
- Headache
- “Pressure in head”
- Neck Pain
- Nausea or vomiting
- Dizziness
- Blurred vision
- Balance problems
- Sensitivity to light
- Sensitivity to noise
- Feeling slowed down
- Feeling like “in a fog”
- “Don’t feel right”
- Difficulty concentrating
- Difficulty remembering
- Fatigue or low energy
- Confusion
- Drowsiness
- More emotional
- Irritability
- Sadness
- Nervous or anxious

2. Memory function

Failure to answer all questions correctly may suggest a concussion.

“At what venue are we at today?”

“Which half is it now?”

“Who scored last in this game?”

“What team did you play last week / game?”

“Did your team win the last game?”

3. Balance testing

Instructions for tandem stance

“Now stand heel-to-toe with your **non-dominant foot in back**. Your weight should be evenly distributed across both feet. You should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes.”

Observe the athlete for 20 seconds. If they make more than 5 errors (such as lift their hands off their hips; open their eyes; lift their forefoot or heel; step, stumble, or fall; or remain out of the start position for more than 5 seconds) then this may suggest a concussion.

Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, urgently assessed medically, should not be left alone and should not drive a motor vehicle.

This can be downloaded at: <http://www.thinkfirst.ca>

A concussion is a medical diagnosis. It can not be determined by a adolescent, parent, teacher, trainer or coach. If you suspect a concussion, seek immediate medical assessment.



Quick fact: The assessment after a concussion most commonly done by doctors is called a neurological exam. This is comprised of a series of questions and tests that will display important information about how the brain and other parts of the nervous system are working.

The brain is divided into four lobes and each lobe performs many different brain functions. Depending where the brain is struck will determine what parts of the brain are affected.

1. Frontal Lobe:

Reasoning, planning, parts of speech, movement, emotions and problem solving

2. Parietal Lobe:

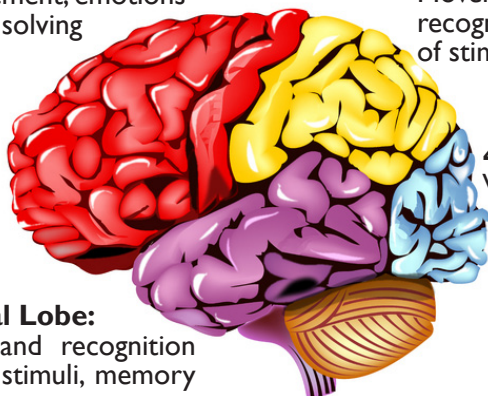
Movement, orientation, recognition, perception of stimuli

4. Occipital Lobe:

Visual processing

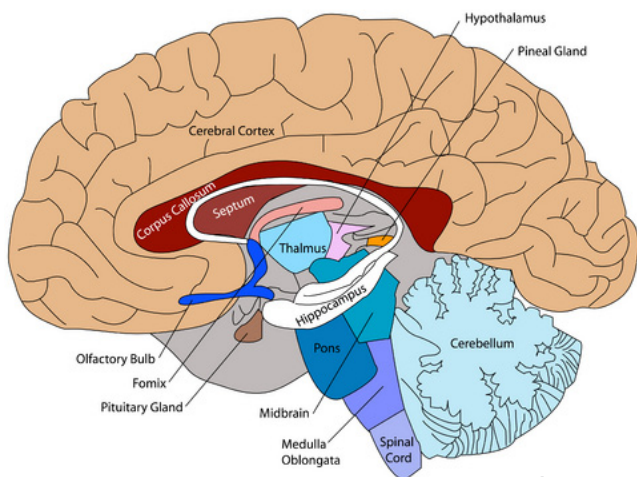
3. Temporal Lobe:

Perception and recognition of auditory stimuli, memory and speech



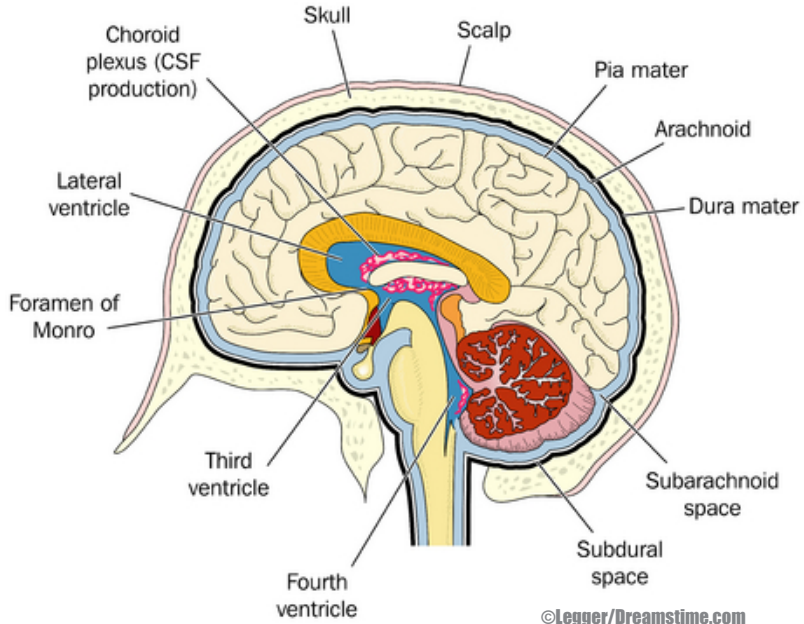
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Imagine if you were to slice the brain in half, this is what it would look like. What areas become damaged depends on the type and severity of the injury.

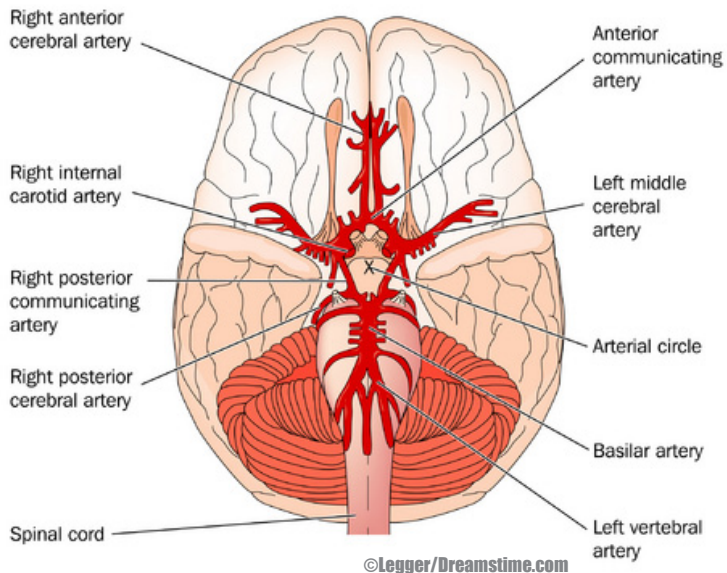


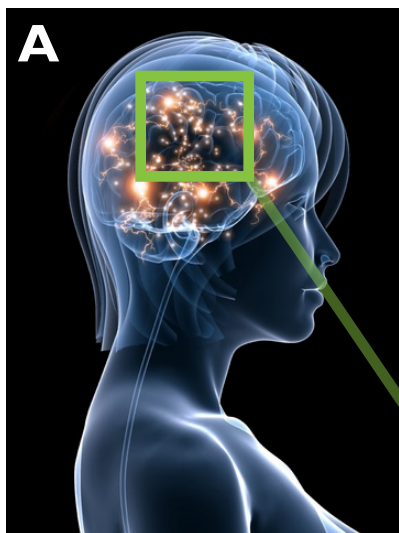
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This diagram shows the various membrane layers under the skull, surrounding the brain. A head injury can affect one or more of these layers. These membranes that cover the brain can be torn or damaged if the brain collides with ridges in the skull.



This diagram shows the arteries at the base of the brain called the Circle of Willis. These arteries supply the brain with blood and are connected through a looping pattern, which helps blood flow reach different brain regions. If blockage or injury occurs to these arteries, there can be serious consequences from not having blood reach parts of the brain or blood spilling into areas where it does not belong.

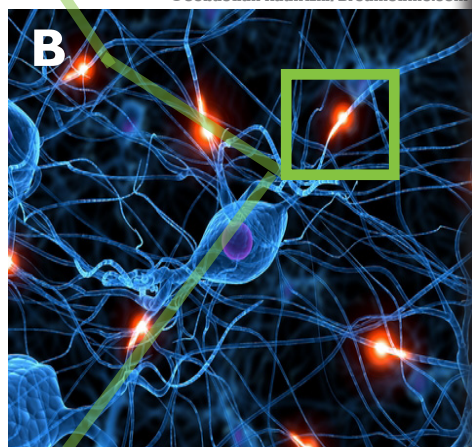




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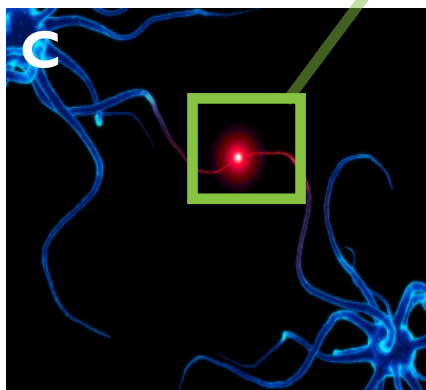
- The human brain includes about 100 billion specialized cells, called neurons.
- They communicate with each other through complex chemical and electrical signals. When this signaling occurs, it's called a neuron firing.
- Diagram A depicts the firing of many neurons, while Diagram B is a magnified view of the firing of a single neuron.
- The firing of neurons in specific areas signals that the brain is active in that area.

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- Neurons manufacture chemicals called neurotransmitters. They help transmit the chemical/electrical signal at the end of the branches, called the axon.
- These signals then make contact with other brain cells, at a location called the synapse, shown in Diagram C. This is how information is transmitted from one neuron to another.
- If there is damage to these cells or their connections, then information does not get transmitted. This will cause the brain to not operate properly.

- When multiple connections establish between neurons, a complex network of neuronal and axonal connections is created, like in Diagram B.
- Many brain injuries can affect the communication between neurons at the network level.
- For example, although injury can happen in a part of the brain that doesn't control balance, the brain is so interconnected that damage to one part can interfere with the communication network of other parts. Which then can translate into affecting the brains' control of balance.



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Treatment

For a **mild brain injury**, the focus is on symptom management such as:

- ⊙ Rest
- ⊙ Gradual transition back to school
- ⊙ Treatment of headaches
- ⊙ Avoiding multitasking and stress
- ⊙ Reduced amount and complexity of cognitive tasks
- ⊙ Following a medically supervised return to play/activity process

If symptoms persist, post concussive syndrome may be diagnosed and the adolescent may need to see a neurologist, or another health care professional specializing in diagnosis and management of post concussion syndrome.

For **moderate to severe brain injury**, an accurate assessment of the brain's function is necessary because it allows health professionals to design the most appropriate rehabilitation program.

Since the brain can undergo many changes following a brain injury, it's important to have a detailed evaluation of a person's overall performance after the injury. For example, it may be beneficial to have an appointment with a specialist, such as a speech-language pathologist, occupational therapist or neuropsychologist. These professionals will conduct different types of tests that may involve computer based evaluations and some will require real life skills assessment, such as travelling or shopping. This will help the health care team design a specific and uniquely tailored treatment plan, and will also help them to measure improvement over time.

An important part of getting help is through a neuropsychological assessment. This type of assessment examines how a person's brain is working. The adolescent will talk with a neuropsychologist to describe how the brain injury has affected their life. For example, it may have affected their thinking skills, emotional control or social skills. The adolescent will also complete a series of written or computer based tests that measure different brain functions. The results are then interpreted by a neuropsychologist. A neuropsychological assessment can provide information on a variety of different brain functions, such as:

- | | |
|---------------------------|---|
| ⊙ Attention/concentration | ⊙ Problem solving |
| ⊙ Memory | ⊙ Academic abilities |
| ⊙ Thinking speed | ⊙ Social, emotional and behavioural functioning |
| ⊙ Language | ⊙ Planning and organizational skills |

Post-concussion return to play/activity process

No one should ever return to play on the same day as a confirmed or suspected brain injury - regardless of level of athletic performance. After symptoms are no longer experienced, a gradual (supervised) return to play process can begin. If any signs or symptoms are experienced during the return to play process, the adolescent must be re-evaluated by a physician before trying the activity again. It is extremely important to note that symptoms may not always occur during an activity, they can occur following the activity or even the next day.

The medically supervised steps to return to play:

- 1** No activity, complete rest.
Once cleared by doctor, go to step 2.
- 2** Light aerobic exercise - no resistance training (this could include walking, yoga or tai chi)
- 3** Sport-specific exercise (for example - running in soccer or skating in hockey)
- 4** Non-contact practice
- 5** Full contact training after medical clearance
- 6** Return to game play

These six steps must be supervised by a doctor or other properly trained health provider.

Some tips to help prevent concussions:

- ⊙ Ensure youth wear a seat belt while driving in a car
- ⊙ Act as a role model, wear the proper equipment, don't use alcohol or drugs while driving a vehicle (or bike)
- ⊙ Create awareness and educate youth on the effects of brain injury
- ⊙ Ensure players use the right equipment for game, position or activity
- ⊙ Be sure athletes and recreation participants wear equipment that fits correctly
- ⊙ Promote rules for safety and rules of sport
- ⊙ Promote fair play and sportsmanship



Quick fact: If you suspect someone may have suffered a concussion, it's important they do not return to play the same day of the injury - regardless of the level of athletic performance or how important the game is.

Working with students within the school system who've suffered a concussion:

- ⦿ Most adolescents are in school. Some may suffer a concussion during school activities (such as team sports, physical education classes, etc.) Regardless of where a concussion occurs, the outcome can have an important impact on school, activities and learning.
- ⦿ Restricting mental and physical exertion until asymptomatic and then gradually increasing each is the cornerstone of the treatment strategy. Appropriate school personnel should be informed of the student's condition. This may include: coaches, teachers, nurses, guidance counselors, etc.
- ⦿ Medically supervised steps to return to play/activity must be followed. Do not allow a student/athlete to play until a doctor has provided written permission - regardless of how important they are to the team.
- ⦿ Immediately following a concussion the adolescent may need to rest at home until symptoms have decreased. Return to school may need to be gradual, starting with a few hours per day. If symptoms persist or return, further home rest may be needed. If symptoms are present at school the student should rest in a quiet and supervised location.
- ⦿ Test-taking may be difficult and may need to be modified. Important tests or exams may need to be delayed. It's not a good idea to take a college entrance exam or key tests until symptoms have cleared. Students may need specific testing accommodations, such as teacher assistance, untimed testing or seclusion from distractions. Extra homework time may also be necessary.
- ⦿ Some injured students may experience difficulties with distraction, concentration and mood swings. These may take months to resolve and thus school procedures and expectations may need to be modified.
- ⦿ Light and loud noises can cause problems.
- ⦿ Persistent or severe concussion symptoms may require special educational interventions and plans. In such cases a neuropsychologic examination is recommended.



Quick fact: Following a brain injury, a student's academic performance may change because the brain functions differently and some abilities may be reduced. Therefore, the student's learning style may need to be changed. School accommodations or course modifications may be required to help the student reach their potential and decrease frustration.

When a youth with a brain injury returns to school, the results of the assessments that have been done should be shared with the school and used to develop appropriate academic accommodations, adaptations and, if necessary, design an individual program plan. These plans usually rely on using the student's strengths to compensate for deficits, providing support for memory, organization and modifying academic expectations. It's important for not only family members and health professionals to monitor the adolescent's emotions and behaviour, but teachers and other educators to monitor it as well.

Potential problems followed by helping suggestions for use in the classroom

Challenges	Helping
You may notice the student's concentration and attention span to be very short.	Allow more time for task completion. A quiet, non-distracting environment can also help.
The student may have a hard time recalling material and repeating what they have learned.	Using cue cards, rephrasing material in their own words and other mnemonic devices can help with memory and learning.
You may notice the student beginning to have problems speaking and communicating with others.	Refer them to a speech and language therapist to learn helpful techniques.
You may see the student get more anxious or tired throughout the day.	Allow more frequent breaks and briefly excuse them from class if necessary.
You may begin to notice that it takes the student longer to think things through and complete tasks.	Allow for more time to complete tasks and assignments. Outside help (such as a tutor) may be necessary.
The student's personality or behaviour can change, sometimes radically, depending on the injury.	The student may benefit from receiving behavioural support at home and school. Sometimes psychological treatment or medication will be needed.

Depression is one of the most common mental disorders in young people, and can occur in youth who have suffered a brain injury. In some cases the effects of a concussion can mimic depression and sometimes the effects of a concussion may increase the risk of developing depression.

Some signs of depression to watch for include:

- ⊙ Predominantly depressed or sad mood
- ⊙ Lack of interest or pleasure in once enjoyed activities
- ⊙ Lack of motivation
- ⊙ Lack of energy
- ⊙ Suicidal thoughts
- ⊙ Hopelessness
- ⊙ Appetite or weight changes
- ⊙ Irregular sleep patterns (too much or too little)

It's likely the adolescent will feel in sort of a "low" mood after a concussion. This will get better over time. To help speed up the recovery process encourage young people to try the following after other symptoms have improved and with medical consent.

Light exercise:

20-30 minutes of walking every day (once medically cleared)

Eating:

Healthy foods like fruits and vegetables and drink lots of water

Avoid drugs:

Do not use drugs or alcohol

Social activities:

Spend time with their family and friends daily, in positive activities and atmospheres

Light:

Go outside and get some fresh air, keep out of dark gloomy areas

Sleep:

Be sure they get at least 9 hours of sleep each night

Talk:

If you feel comfortable, talk to them about how they are feeling, see if they will open up to you in ways you can help

Quick fact: A concussion can occur even if a player is wearing a helmet.



Brain injury during adolescence is most common while playing contact sports. These injuries can sometimes have permanent and severe consequences. For example, sports such as hockey, football, soccer, rugby and boxing have a high number of reported concussions. It's important that athletic organizations work to improve players' safety by ensuring the proper equipment is being worn and the rules are revised to ensure the safety of the players.

As adults you can help by:

- ⊙ Making sure the proper equipment is being used correctly
- ⊙ Ensuring the equipment is up to date and safe
- ⊙ Ensuring the equipment meets national certification standards
- ⊙ Making sure activities are appropriate for the youth's skill and comfort level
- ⊙ Keeping a record of any concussions if they occur

If you suspect that an adolescent may have suffered a concussion, it's important that you:



- | | |
|--|---|
| <ul style="list-style-type: none"> ○ Check for symptoms ○ Take the adolescent for a medical check-up (if parent not available, ensure that a responsible adult does this). | <ul style="list-style-type: none"> ○ Do not allow the adolescent to go back to playing until they have written medical clearance |
|--|---|



Quick fact: For young athletes, it's better to miss one or more games than the whole season. Take the proper precautions and listen to the doctor. Do not allow them to go back to play until the doctor says it's safe.

Family Impact

It can be easy for family members to get overwhelmed and so preoccupied with the brain-injured adolescent that they forget to take care of themselves or other children. Having a family member with a brain injury can be demanding on the family, it's important to:

- Strive to maintain a balanced lifestyle to help cope with the stress
- Seek professional help, such as therapy or counseling, if the stress becomes problematic

Remember it often takes longer for adolescents to recover from a concussion than an adult with the same condition.

Professional assistance can help prepare and develop strategies to cope with the situation more positively. Your health care providers should be able to give you a list of resources in the community where you can get help.



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BE SUPPORTIVE, RECOVERY TAKES TIME

For more information about concussions and young athletes check out these resources:

ThinkFirst.ca

ThinkFirst teaches school-aged children and youth, sports teams, and community volunteers, to safely participate in the activities they enjoy. Their primary goal is to strive towards a future free of traumatic brain injury and spinal cord injuries. They have an abundance of online resources in both of these categories.

Centers for Disease Control and Prevention

www.cdc.gov

The CDC works to protect public health and safety by providing information to enhance health decisions, and it promotes health through partnerships with state health departments and other organizations.

Other Online Resources:

General information about the teen brain and teen mental health:

www.teenmentalhealth.org

www.brainline.org

Brain injury and school: a problem solving system for students with brain injury

www.projectlearn.net.org

Brain injury guides for educators:

www.bced.gov.bc.ca/specialed/docs/moe_abi_resource_rb0116.pdf

Brain Injury Association of Canada

www.biac-aclc.ca

Medical care after brain injury

www.tbirecoverycenter.org/treatment.htm

Sport Concussion Assessment Tool (SCAT)

www.cces.ca/en/files-116

Books:

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CONCUSSION AWARENESS

Definition:

A head-trauma-induced alteration in mental status that may or may not involve a loss of consciousness.

*People who have lost consciousness have a concussion or worse!
A person does not need to lose consciousness to have a concussion!*

A concussion may be caused by a direct blow to the head, face, neck or anywhere else on the body that causes a severe and sudden movement to the head.

COMMON SIGNS AND SYMPTOMS

Symptoms are often subtle

- headache
- pressure in head
- neck pain
- dizziness
- balance problems
- nausea and vomiting
- vision problems
- hearing problems/ringing
- “don’t feel right”
- feeling “dinged” or “dazed”
- confusion
- feeling slowed down
- feeling like in “a fog”
- drowsiness
- fatigue or low energy
- more emotional than usual
- irritability
- difficulty concentrating
- difficulty remembering

PREVENTION - Reduce the risk of brain injury:

1. Appropriate protective equipment should be worn properly and replaced when damaged. Approved helmets should be used in all activities with a risk of head trauma.
2. Adhere to the rules of the sport or activity. Play fair and play smart!
3. Respect all participants.

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Capital Health

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This page can be used to help teach players, coaches, teachers and parents about concussions.

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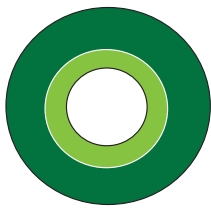
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Brain Injury Association of Canada
Association canadienne des lésés cérébraux
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Dr. Stan Kutcher: skutcher@dal.ca

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