

# A Brief 5000 Year History of Accidents and Injuries

**We're all lucky to live in the 20th century.** At AICA, we see patients who get into an accident and need a lot of physical therapy. But the truth is--we stand on the shoulders of thousands of years of accident-injury prevention. From earliest mankind, to the rapid innovation of the 1900's, we're all in better shape thanks to all the slow, painful work that came before.

## Part 1. Humans Always Get Into Trouble

### The Spine in Ancient Egypt

People have always had a problem with a combination of two things: Accidents + Spines.

Between 3,000 and 2,500 BC, the ancient Egyptians had the same troubles with their backs that we do. The oldest known, surviving papyrus that details cases of trauma is called the Edwin Smith Papyrus. It presents 48 cases, six dealing

with the spine. Case 30 shows the least disabling type of spinal injury, a cervical sprain with disc injury. This is the earliest case of whiplash. The Egyptians wrote:

“Treatment for a wrenching in the vertebral column of the back of his neck.

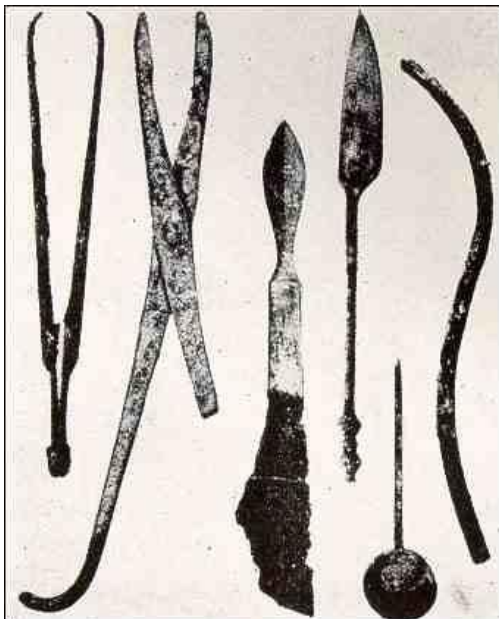
#### *Examination:*

You are to say to him: “Look towards both your shoulders and your chest”. When he does so, the ‘looking’ he is capable of, is painful.

#### *Diagnosis*

Then you are to say to him: “one who suffers from a wrenching/sprain in the vertebral column of the back of his neck (this is) a medical condition I can heal”.

#### *Treatment*



Egyptian Surgical Instruments

You have to bind it over fresh meat the first day. Afterward, you should treat with (powdered) alum and honey every day until he recovers.

### *Explanation*

As for ‘the wrenching/sprain’, he says about the wrenching apart in intervertebral joints: “Each vertebra is (still) in its place”.<sup>1</sup>

Ancient whiplash patients were lucky. They could be treated. For more serious injuries, such as a crushed vertebrae, ruptured discs and paralysis, the Egyptian doctor would simply say:

“I cannot heal.”



### **Other Forms of Ancient Spinal Treatment**

In 400 BC, things hadn't changed much. It's said the ancient Babylonians had methods to treat back pain. So did the Balinese, Hawaiian Lomi-Lomi, Eastern and South Asians, Shamans of Central Asia, and bone setters the world over. Spinal manipulators trained small bears to walk up and down a man's spine, and offered such services for a fee. The additional weight of the bear popped in bones better than they could themselves. In the Netherlands Indies, babies born feet-first on the island of Nias are still believed to have special talents for manipulating the joints.

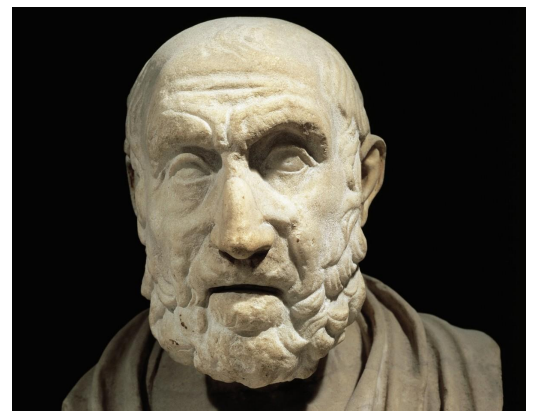
### **Rise of Modern Medicine--Hippocrates**

You've heard of Hippocrates oath? This Greek father of medicine, who lived from 460 to 370 BC, wrote at least three works on bones and joints, far before the advent of chiropractic:

1. *On Fractures;*

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<sup>1</sup> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2989268/>

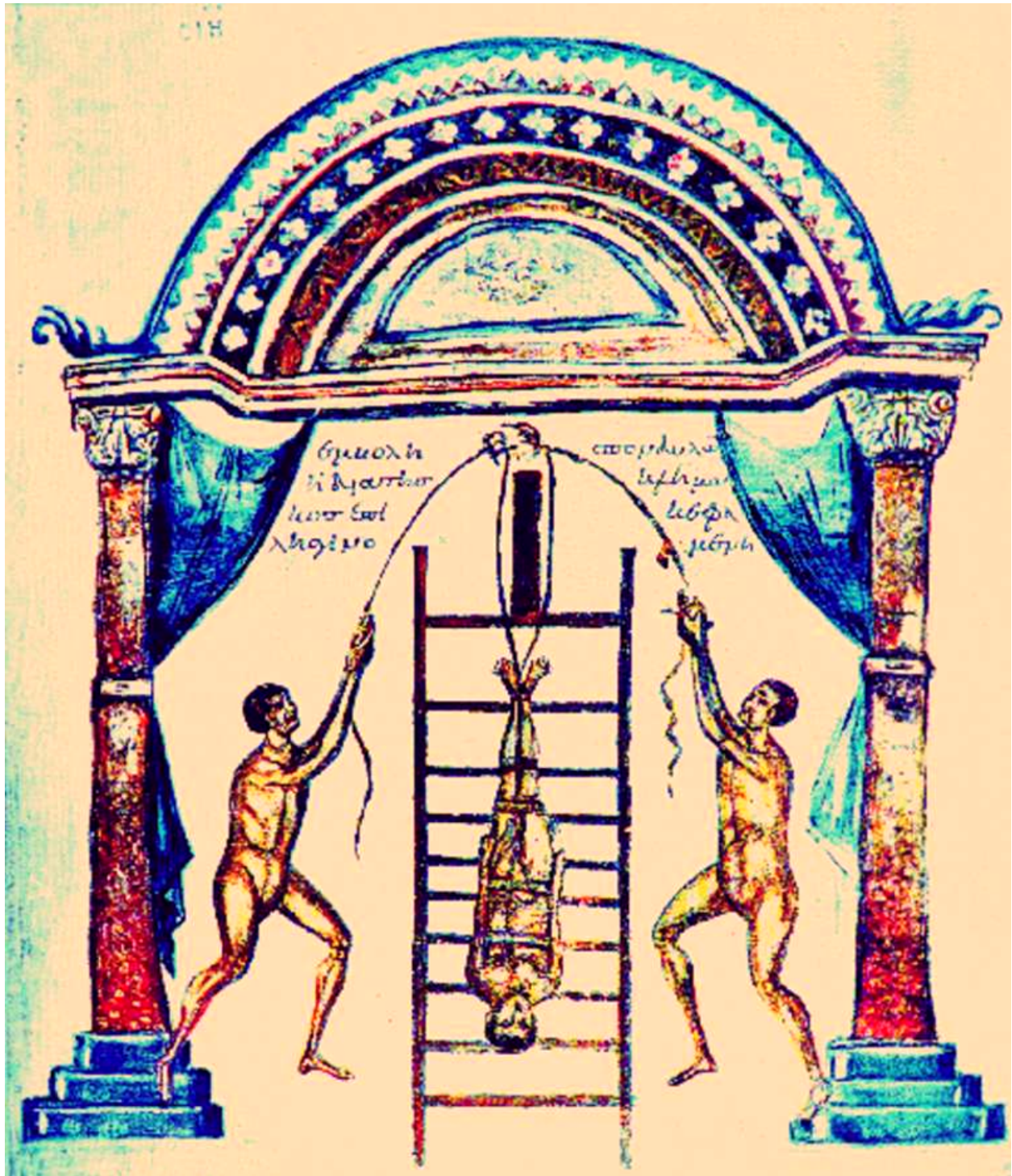


2. *On the Articulations;*
3. *On Setting Joints by Leverage.*

The aphorism: "Look well to the spine for the cause of disease," a chiropractic maxim, is said to have been written by Hippocrates. His achievements included recognizing the existence of symptoms that made their way over the spinal nerves, and that would exit in relation to an injured or diseased vertebrae.

He was the first to write that paralysis was caused by injury to the spinal column. In the western world, Hippocrates was the first we know of to use spinal traction to treat scoliosis. (He tied his patient to a ladder upside-down.) He designed a table, fitted with straps, axles and wheels, on which his patient would be stretched into shape. A lever could align a "gibbus" or out of place vertebrae. This table was so ingeniously designed that for over 1600 years, no one could

think of anything better.



Claudius Galen, the physician who followed Hippocrates and sewed the wounds of Roman gladiators, wrote of Amazonian women who purposely dislocated the hips of some of their male children to compel them to work. When Spanish conqueror Hernando Cortez invaded Mexico in the 16th century, Aztec doctors were "concerting the bones," or manipulating the

joints, as an essential requirement of the more qualified doctor's duties.



*Galen.*

**Medieval Bone Setters**

In 1580, Ambrose Pare served four different kings of France, and advised manipulation for cases of spinal curvature. Later, in 1656, *The Complete Bone Setter* was written in England by Friar Thomas. It's incredible subtitle: *Wherein the Method of Curing Broken Bones, and Strains, and Dislocated Joints, Together with Ruptures, Vulgarly Broken Bellies, is Fully Demonstrated: Whereunto is Added the Perfect Oculist, and The Mirrour of Health ... Also the Acute Judgement of Urines.*

The book is intended for "the use of those Godly Ladies and Gentlewomen, who are industrious for their talent God has given them, in helping their poor sick neighbors." This implies that it was women who would reset joints. The most famous was Sally Mapp, who began her career caring for race horses, and eventually treated a prominent doctor's daughter. She decorated her stately carriage with crutches of the people she healed.

### **The Connection Between Bones and How We Travel.**

While bone setting and the early roots of chiropractic show us that we've been dealing with accident injury for thousands of years, the rise of new forms of transportation and technology have led to more. More accidents, more severe accidents, and concurrently, more forms of effective treatment.



Ambrose Pare

What hasn't changed is the spine. We're all held upright by an incredibly sophisticated length of bones and soft tissue, with miles of nerve networks that each stem through facet joints.

At the top, the Cervical spine, are the bones connecting to your skull: the Atlas (C1) and Axis (C2). Next, your Thoracic vertebrae are in the middle of your back, making up most of its length. These are followed by the thicker Lumbar vertebrae in your lower back, and the Sacral bones at the bottom. Inside your 33 vertebrae, the spinal nerve is what transports the signals from your brain and your body. You have 31 pairs of spinal nerves. Eight pairs of cervical nerves,

twelve pairs of thoracic nerves, five pairs of lumbar nerves, five pairs of sacral nerves and one pair of coccygeal nerves.

Specifically:

C1 and C2.	Those control your head and neck movement.
C1 through C4.	Control your breathing.
C4 through C6.	Control your heartbeat.
C6 through C8.	Allow your wrist and elbow to move.
C7 through T1.	Allow your hand and fingers to move.
T1 through T12.	Sympathetic nervous system
T11 through L2	Hip motion, intestines
L3	Knee extension
L5	Knee flexion
L4 through S1	Foot motion
S2 through S5	Bowel and bladder activity, reproduction

Injury to the spinal cord is called myelopathy, and the result is paraplegia or quadriplegia. These injuries are typically permanent, since nerve fibers in the spinal cord don't regenerate.

However, in a mild injury, or one from which the patient has largely recovered, chiropractic may help. It can speed recovery by aligning the vertebrae, release pressure against the nerves, improve blood flow and minimize pain, while encouraging the body to heal.

## **Part II--Vehicular Accident Injury**

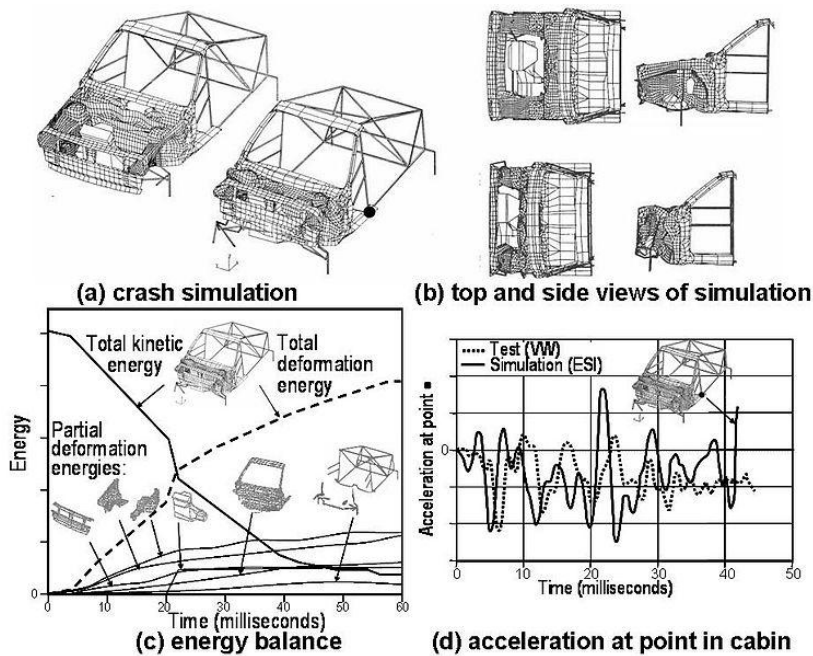
Egyptologists are now pretty sure that King Tut, the boy king who died at 19, was killed in a terrible chariot accident. Studies of his exhumed remains indicate that he'd likely been on his knees while his pelvis and ribs were crushed and his heart mangled in 1324 BC. As if to add insult to injury, after he was embalmed, the mixing of oils and linen inside his tomb burned the Pharaoh's mummified body at over 392 degrees.

The reason that King Tutankhamun sustained those injuries can be explained with the simple physics of a car crash...



## How Cars Move in an Accident.

As speeds have increased, and materials and objects involved in accidents have grown harder and sharper than what was known in antiquity (think glass, asphalt and steering columns) chiropractic is often not an option. [During a car crash](#), there's a lot of kinetic energy



getting tossed around. The energy of the vehicle is transferred into what it hits. Depending on what that object is, it will either absorb the energy or release it back into the car.

The force that acts on the car (what it hits) causes an immediate deceleration from  $V$  (whatever the velocity is) to 0 velocity. [All of that energy has to go somewhere](#), and will be released as heat, sound and pressure against the vehicle and its occupants.

Cars hitting oncoming cars release more energy than cars hitting immovable objects, such as this example, in which the car is totaled at 140 miles an hour. That's why atomic energy scientists, who want to study particles to identify their highest rates of energy, crash atomic particles headlong into each other and not solid objects.

So in a car crash involving two oncoming vehicles, there is so much energy that parts of the cars break apart, melt and combust. Just like atoms. With enough energy the two oncoming cars will fuse together. Without the proper safety equipment, their occupants will do the same.

## Human Response in an Accident

Objects in motion tend to stay in motion. In the event of a crash, our bodies are moving at the same speed as the car. Incidentally, due to the traumatic nature of this event, our brains and nervous system activate fight or flight when a crash is imminent.

We feel less pain. Perhaps no pain.

We have more energy, oxygen and blood-rush as our lungs and blood vessels dilate.

We have increased strength.



Our peripheral vision is cut off, so we only see what's ahead.  
Same with our hearing--it mutes extraneous sounds.

All of this is designed naturally to help us survive an accident. But it took a long time for people to catch up and design the safety equipment that would help us survive increasingly motorized technology. Throughout history, all engineers had to deal with were people running, people riding horses, and then people on chariots.

Nobody went much faster than 20 or 30 miles per hour.

### **Trains, Planes and Automobiles**

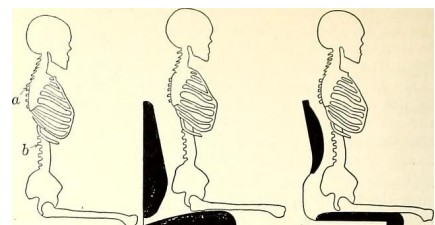


Before there were car accidents, there was every other kind...[starting with trains](#). The original motorized transport accident, which affected the spine in particular, was dubbed "railway spine." That's because before there were mechanized cars, there were trains.

On a typical train car, the passenger often sat with his back to the front, which meant his back faced the acceleration. In the event of a crash, the neck was injured from the sudden change in velocity. This became known as railway spine.

Eric Erichsen wrote, *On Railway and Other Injuries of the Nervous System*, the first book to identify what would become known as whiplash. What the ancient Egyptians called "wrenching." These early locomotive cases formed some of the concepts behind chiropractic.

"It must...be obvious," Erichsen said, "that in no ordinary accident can the shock be so great as in those that occur on Railways. The rapidity of the movement, the momentum of the persons injured, the suddenness of its arrest, the helplessness of the sufferers, and the natural perturbation of the mind that must disturb the bravest, are all circumstance that of necessity greatly increase the severity resulting to the nervous system, and the justly cause the cases to be considered somewhat exceptional from



ordinary accident.”



Charles Dickens tending to injured after his train crash

Consider, at the time of writing, a transportation accident was considered exceptional, and not normal. Erichsen's ideas about grew steam, and the book was the first to speak about motorized transport accidents, so that people came to expect that spinal injury was part and parcel of railway travel.

It also began the idea that a host of symptoms can arise without a locatable injury--similar to PTSD. Before there was



internet, what people did was crash locomotives together for fun. This is what happened during [the train crash at "Crush," Texas.](#)



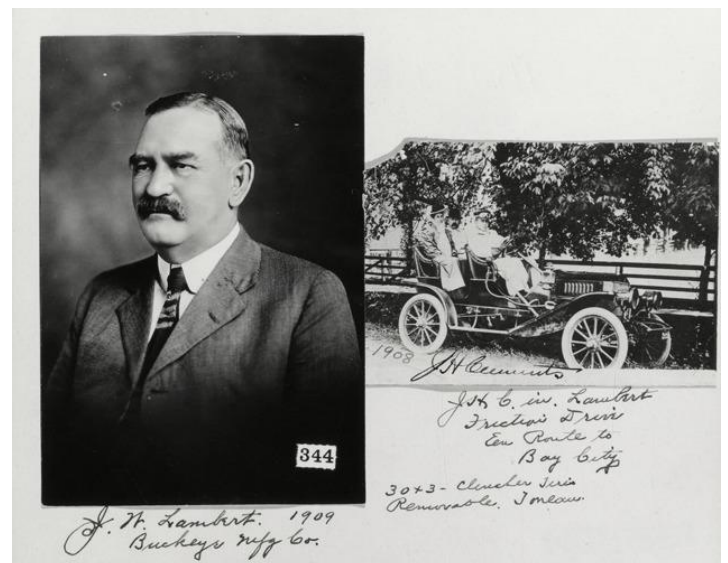
### The First Car Accidents

The first car accident victim ever occurred in 1869: Mary Ward, 42, an Anglo-Irish naturalist, astronomer, author, artist and microscopist, who in Ireland, was thrown at a sharp bend from an experimental steam powered car, built by her cousins, and fell under its heavy wheels. She was killed instantly from a broken neck.



The first car accident collision occurred in 1890. Inspired by the vehicles built by Karl Benz in Germany in the 1880's, John William Lambert constructed the first American, gasoline powered, single-cylinder motor-vehicle. He did it in absolute secrecy in 1890. He'd agreed to spend \$200 to on the design of a lightweight engine. After spending \$3300, he had the unfinished vehicle moved to his property.

It was a buggy. The first three-wheeler...with two rear wheels, and a front wheel chopped off a wheelbarrow. He designed a make-shift carburetor that he reverse engineered after seeing one onboard a ship. Lambert achieved a top speed of five miles per hour. (So the first accident in motor vehicle history wasn't so bad.) It was only at night when Lambert and James Swoveland



could test the vehicle in secret. The pair collided with a tree root, lost control--and ironically--smashed into a hitching post; horses got even at the birth of the automobile, by indirectly causing the first accident. Lambert and his quest for motor driven transport is commemorated every year during Lambert Days in Ohio City, Ohio.

Lambert's accident was in no way a preview of car accidents to come. The rising scale of speed, power and population has made auto accidents one of the most prevalent ways to be hurt. Railway spine was already a part of the traveler's injury repertoire, but the slow speed early cars could go meant that making them safer was still far in the future.

Lambert and his car

By the late 1800's, motorized taxi cabs were operating in New York. By the turn of the century there would be over 1000 of them. In 1899, the first speeding ticket was issued to Jacob German--a cabbie. Later that year, on September 13th, as Henry Bliss helped a friend exit a streetcar, he was struck in the head by a motor taxi, becoming the first pedestrian killed by a car in the United States.

Safety had a long way to go.

### **Seatbelts**

Nothing beats a seatbelt. It's the most effective way to save life and reduce injuries in an accident. More than half the people who die in accidents, aged 13 through 44 years old, are not wearing seatbelts. As we've discussed above, that means that once the car stopped, they continued to move at the velocity the car was moving at the instant prior to the crash.

Who gets the credit for seatbelts? An early aeronautical engineer. George Cayley, an English engineer in the late 1800's created a beltlike contraption to help keep pilots inside their gliders. However, the first patented seat belt was created by American Edward J. Claghorn on February 10, 1885. This was a luxury--to keep anxious tourists safe in taxis in New York City.

(The real New Yorkers, apparently, didn't need them.)

Over time, the seat belt slowly began to appear in passenger cars. However, there wasn't yet wide concern over driving safety. Finally, in the 1930's, doctors began testing the function and results of lap belts, and saw what a difference they made during a crash. Manufacturers were then urged to introduce them.

Still, it wasn't until 1954 that the Sports Car Club of America required belts on competing drivers. It was race car drivers who began the trend.

Then in 1958, Volvo became the safest car in the world when it hired Swedish engineer, Nils Bohlin to create a better belt. Using the hard metal car frame as support, Bohlin invented

the three-point seatbelt. This was the first passenger car belt that supported both the lower and upper body. This model was eventually adopted across all the car-makers, but it took time to enforce.

By 1964, despite Bohlin's invention, over a million people had died from steering wheel impact. In 1966, that Ralph Nader's book *Unsafe at Any Speed* went after the auto industry for refusing to install essential safety mechanisms in mass production vehicles. That led to the first US law to require all cars and trucks to have safety belts.

When Bohlin died in 2002, Volvo ventured an estimate that his seatbelt had saved over one-million people.

### **Flight Tests**

With seatbelt safety increased, that still left a lot of room for improvement. There were unanswered questions: How does the human body react in a crash? How much deceleration can a human endure? And how should engineers respond?



Bohlin with 3 point belt

These questions weren't first asked by the automakers. They were asked by John Paul Stapp, M.D. Ph.D., Colonel, USAF, pioneer and guinea pig, who volunteered his own body to study the limits of human acceleration and deceleration. Stapp wanted to know the maximum speed that pilots could safely eject. To do so, he volunteered for 26 potentially lethal experiments.

The most fantastic: In December of 1974, [he became the fastest man ever on earth](#). He traveled at 639 miles per hour in a rocket sled, and he decelerated from that speed in one second. Fighter pilots may pull nine-G's vertically before passing out. This experiment pushed 43-G's against Stapp's body. In that instant of deceleration, he weighed 7,700 pounds. He went temporarily blind; his eyes were bleeding, and had almost popped out of their sockets. Dust had

blown through his flight suit and into his skin leaving rashes and abrasions.



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(As a sobering comparison, [in a car accident at 140 miles per hour](#) hitting a stationary wall, the occupants may experience 400 g's in 58 milliseconds.)

This selfless and heroic work led to the development of the world's first crash test dummy, Sierra Sam. [Then to sled impact tests](#). Stapp shared his air force test results with the auto industry in 1956. Later, the GM Proving Ground created the first automotive impact sled, called the HY-GE sled, in 1962.

### **Car Crash Tests**

While the Air Force let up of Stapp, and began using dummies, there were still human volunteers testing car crashes. These were doctors and engineers. When the velocity was increased, the car makers--more interested in engineering advances than proper burial--switched first to human cadavers. The problem is that human cadavers don't provide the best data. In a crash, cadavers don't move like living tissue. So much so, that a live animal's bone and tissue injuries will more closely mimic a live human.



Cadaver Testing

So, the first test animals were pigs. Followed by dogs monkeys and calves. When animal crash testing was stopped in 1993, an astonishing number of over 19,000 animals had been killed to create safer automobiles. One included an anesthetized bear in clothes, with its jaws tied together and a seat belt around its chest. Live baboons were killed in impact sled tests, (skewing data, since they react differently to head trauma.)

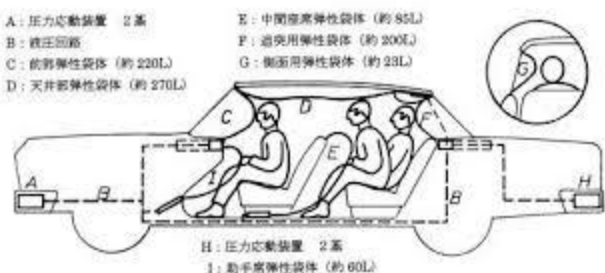
Then there is the [Volvo moose strike](#).



## Airbags

Since the 1950's experiments were underway in airbags. John W. Hetrick gets the credit for inventing the airbag. He got the idea after being in an accident, driving on a Sunday outing with his wife and daughter sitting together on the front bench seat. Coming over a hill, he swerved to avoid a boulder in the road and flew into a ditch. Instinctively, both he and his wife reached out to shield their daughter from hitting the dashboard. When he got home, he began to design a plan for a cushion that could inflate prior to a vehicle's impact.

His idea came from his time as a naval engineer. Once, while repairing a torpedo, its compressed gas propellant activated, causing the canvas cover around it to inflate all the way to the ceiling.



In 1964, Yasuzaburou Kobori, a Japanese engineer, invented an explosive charge that



would instantly inflate the airbag.

Allen Breed later invented the first crash-sensor airbag system. In 1971, Ford finally built a line of experimental airbag equipped cars. GM installed airbags in government-issue, Chevrolet Impalas. However in 1977, they discontinued airbag use, and Ford and GM began to lobby against them. It wasn't until 1984 that they made airbags an option on the Ford Tempo. In fact, it wasn't until the 1990's that airbags became a standard feature, this being written into law in 1998.

### **PART III. Car Accident Injury and Therapy**

The oldest case of a spinal injury is from Russia. An early Neolithic hunter-gatherer, in what is now Siberia, was unearthed by the Irkutsk State University. Around 8000 years ago, this man was shot in the spine with an arrow, likely fleeing an attacker. What is remarkable is that his bone healed around the arrowhead, which indicates he survived with a spinal cord injury that one archaeologist said would today be a death sentence without immediate hospital care.

He was obviously cared for by the rest of his companions, and when he died, he was buried with honor, as a





variety of ornamental artifacts were unearthed in his ancient grave.

### **Spinal Cord Injury.**

It was spinal cord injury, or SCI, that in ancient Egypt was a condition “not to be treated.” However, it wasn’t until Aulus Cornelius Celsus, born in 30 BC, wrote that a neck injury results in quick death, that the spinal cord was implicated in the injury. Greek doctor Galen found that cutting this part of the neck in monkeys resulted in the animals losing all movement and sensation.

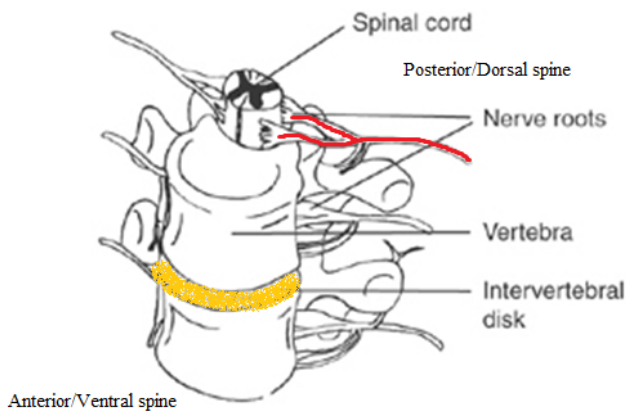
In the 7th century, the Greek physician Paul of Aegina wrote about how to surgically treat broken vertebrae, by removing pieces of bone, and easing pressure. Little medical progress was made in Europe during the Middle Ages, and it wasn’t until the Enlightenment that the spine--its bones and nerves--were drawn accurately by Andreas Vesalius, and Leonardo da Vinci.

### DaVinci’s Spine

Then in 1762, a surgeon by the name of Andre Louis took out a bullet that was lodged in the lumbar spine of a paraplegic, who was able to regain leg movement.

In 1829, a surgeon named Gilpin Smith restored a patient’s sensation with laminectomy, or spinal decompression surgery. These early cases of recovery from SCI were notable, because the doctoral consensus was in many ways unchanged since ancient Egypt; SCI was untreatable. In the early 20th century, 80 percent of SCI victims died within two years of sustaining their injuries, often because of infected pressure sores and urinary tract infections.

It wasn’t until advances in medical imaging, surgery and after accident care did spinal injury become commonly treatable. Since 1940, SCI survival, thanks in part to effective first response, is up 2000 percent.



SCI is present in about two percent of blunt force trauma accidents. In 44 percent of SCI cases, there are other serious injuries sustained at the time of the accident. 14 percent experience head or facial trauma. Other injuries are chest and abdominal trauma and bone fractures.

### **Chronic Pain of SCI**

People with SCI often have musculoskeletal and/or neuropathic pain, which is near the site of the injury. Remedies include trying to heal

the cause of pain, as well as other aggravating conditions, like poor posture, overuse and lack of exercise or poor nutrition.

When patients can't get relief from medication, they should seek out other forms of treatment. These include massage, acupuncture, medically prescribed cannabis, chiropractic manipulation, biofeedback and relaxation training, magnets, and hypnosis.

### **Concussion**

The word concussion comes from Latin *concussus*, meaning, "to shake violently." We know that Hippocrates wrote about it 2400 years ago. Then in the 10th century AD, the Persian doctor, Rhazes, explained that a concussion is not necessarily a brain injury, but a changed physiological state. Later, in the 13th century, a European doctor called Lanfrancus wrote that a concussion is a "commotio cerebri" as opposed to "contusio cerebri." A state of commotion, rather than a state of contusion, or physical damage.

While a spinal cord injury is the most serious accident related injury, the most common is the concussion. All road collisions combined, including automobiles, motorcycles, pedestrians and bicycles, result in at least 200,000 head injuries per year in the United States, a low number, because these statistics are based on loss of consciousness and hospital admissions--not the total number of concussions.

In addition to the lack of an effective means of diagnosis, there is no agreed definition of a concussive threshold.

### **Chiropractic Care and Concussions**

While after-trauma headaches can be treated with analgesics, non-steroid anti-inflammatory medication, a concussion will usually present with a misalignment, or subluxation in the cervical spine.

### **Whiplash**

The most common of all auto-accidents, whiplash is grown up version of the 19th century Railway Spine. In 1995, the Quebec Task Force devised a definition for whiplash and its associated disorders: "An acceleration-deceleration mechanism of energy transferred to the neck which may result from rear end or side impact, predominantly in motor vehicle collisions, but also from diving accidents, and from other mishaps."

This energy transfer will injure the bone or soft tissue, and result in other injuries that are known as whiplash associated disorders, or WAD. These are the levels of whiplash injury:

o, is no neck pain, and no physical signs of injury.

1, is complaints of neck pain complaints, and a stiff or tender neck, but nothing else visible.

2, complaints of neck pain and the addition of musculo-skeletal changes, such as impinged range of motion, and pain at the point of the injury.

3, is complaints of neck pain and neurological signs of weakness, and changes in the senses or the reflexes )

4, is complaints of neck pain with a dislocation or fracture in the cervical spine.

Most sufferers of whiplash have neck pain and headaches. They may also have shoulder or arm pain, numbness, paraesthesia, and auditory or visual symptoms, as well as dizziness.

### **Chiropractic Care and Whiplash**

In many cases, chiropractic care is beneficial for whiplash. A study published in *Injury* showed that chiropractic treatment helped 26 out of the 28 patients who were pained by chronic whiplash syndrome. The chiropractic care administered in these cases included spinal manipulation, proprioceptive neuromuscular facilitation stretching (i.e. stretching) and ice-pack therapy.

The chiropractic neck adjustment will increase spinal mobility, range of motion, and the movement of surrounding muscles. This helps to stop pain and stiffness in the joints. Clinical mobilization, massage and physical therapy can also help move the recovery along. These procedures are appropriate after the initial injury and inflammation have healed.

### **Conclusion**

Technology and safety have advanced dramatically in the past 5000 years. As a small step in the march of history, AICA is proud to be Atlanta's leader in the advancement of accident treatment. AICA is the only multi-specialty orthopedic practice in Atlanta, which includes neurosurgeons, orthopedic surgeons, neurologists, chiropractors, medical doctors and physical therapists.

All owe a debt of acknowledgement to the thousands of people who have worked over millennia to repair the human body, and keep people safe from accident injuries.

