Demonstrative Evidence in the Catastrophic Brain Injury Case

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What a Professional Needs to Know About Traumatic Brain Injury
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Introduction:

Demonstrative evidence can be helpful in brain injury litigation in a number of ways. The most common uses are (1) to clarify injuries evidenced in various imaging studies such as MRIs and CTs, (2) to assist decision makers in understanding and appreciating the surgical procedures the patient has undergone, and (3) to help correlate injuries and neurocognitive deficits directly with a traumatic event.

The capabilities of today's visual imaging specialist can provide the "proof" required by the most skeptical decision maker. Demonstrative aids showing "catastrophic" or "severe" brain injuries are perhaps the easiest to develop because such devastating injuries are typically evident in the objective imaging studies. In cases of questionable liability or in those where recovery is limited, projection of the imaging films themselves or simple color enhanced films can be effective, and the cost is moderate. In cases where the anticipated recovery is significant, there is much the visual consultant can do to make the difference between a decent recovery and a full measure of justice.

Proof of the existence of the injury is most important in the less severe brain injury cases where the defense will deny the fact of injury. In these cases, demonstrative aids may be the only way to a successful outcome. As a general rule, the more subtle the brain injury, the more important demonstrative evidence becomes. It is all a question of convincing proof.

Whether developing demonstrative aids for catastrophic brain injuries or less severe (sometimes referred to as "mild") traumatic brain injuries (TBI's), there are a number of variables and/or approaches that need to be taken into consideration before the development of the products is begun. Several of these variables and/or approaches include the following:

- Importance of accuracy
- Case specificity (demonstrating a "typical" injury or surgery and allowing treating experts to explain how it is similar or different to your client's v. demonstrating a client's "specific" injury and/or surgery)

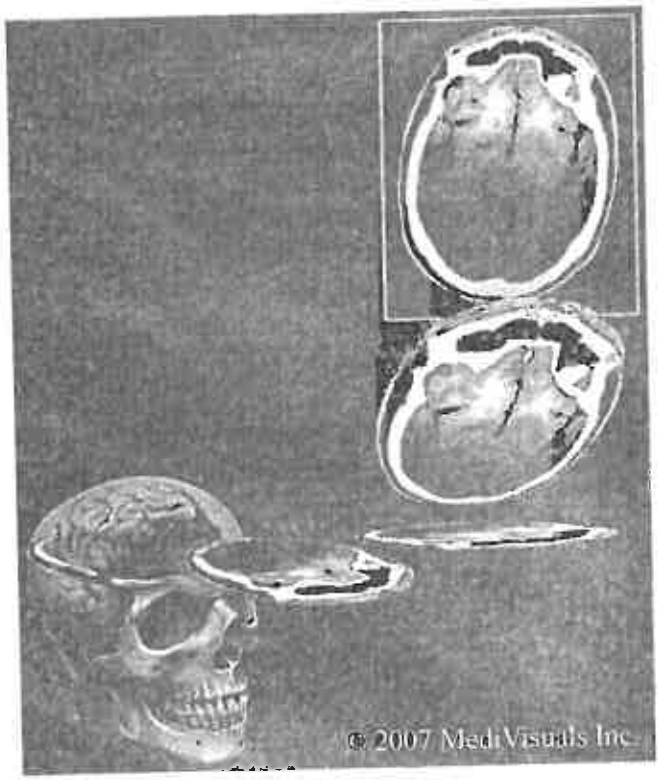
- Aesthetics (quality of drawing, modeling, and/or rendering)
- Style (diagrammatic v. realistic rendering of images)
- Emphasis on "attention" (For the purposes of this paper, "attention" refers to an image or presentation technique that, in and of itself, does not add anything substantive to the demonstrative aid. However, it makes the demonstrative aid more interesting, therefore more likely to hold the attention of the viewer and more memorable.)
- Budget
- Time

Most attorneys would likely agree that they would prefer to have their demonstrative aids developed both so that they attract and hold the attention of decision makers, and so that they are highly accurate, very case specific, and of the highest aesthetic quality. Unfortunately, budget and time constraints most often make it necessary to choose what is most important. In some situations, deciding the approach of emphasis of the demonstrative aids is a matter of the attorney's personal preference and presentation style. In many other situations, however, the known preferences of the court and/or judge who will be hearing the case will essentially dictate how the demonstrative aids are to be developed.

Severe Brain Injuries:

Immediate Injuries:
Because of dramatic advances in animation software and hardware, animations demonstrating injuries and surgeries are now quite affordable. Examples of demonstrative aids showing severe brain injuries include the following:

Scan Selector™: A very effective way to help those involved understand the exact location and orientation of a scan while also retaining the attention of the decision maker. With the Scan Selector™ presentation technique, the scan glides out of the orientation view, allowing the viewer to appreciate the exact level of the scans as well as how it is oriented (left, right, front, back, top, bottom, etc.). A sample of a Scan Selector™ presentation can be viewed at the following link: http://medivisuals.com/content/animations/ctss.html

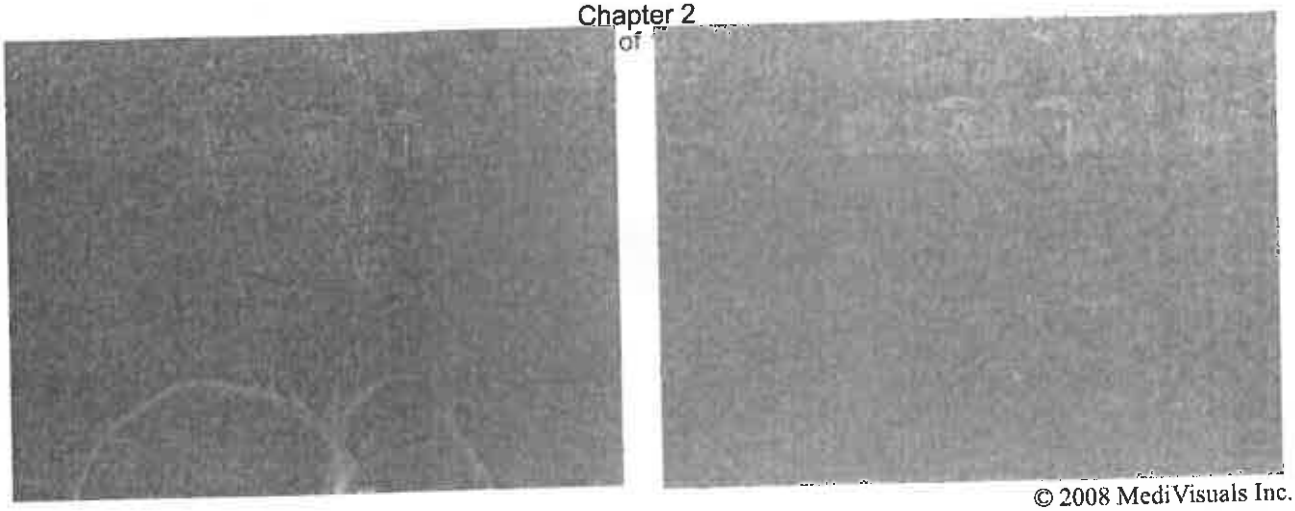


3D digital models can also be very effective demonstrative aids.

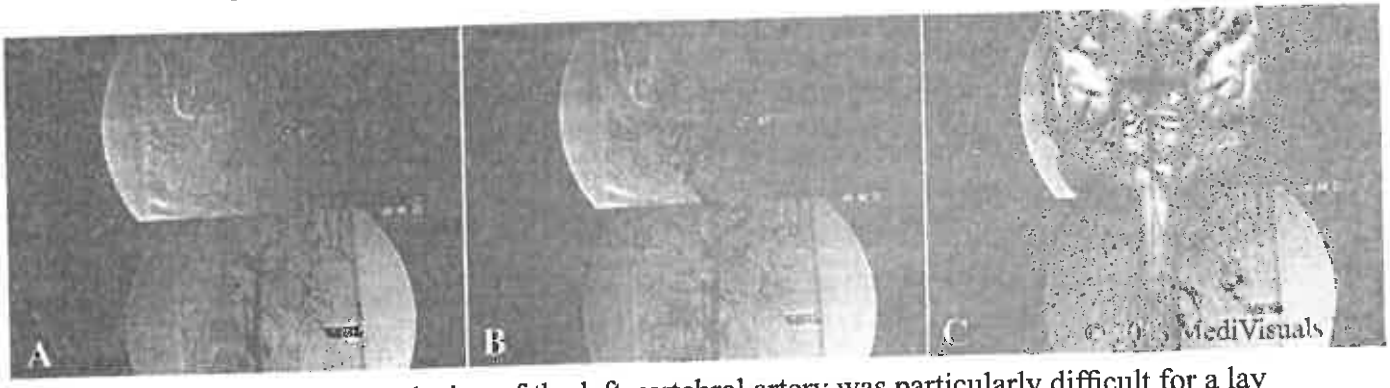
The 3-D digital models shown in the previous sequence can be recreated manually, or, in situations where initial scanning data was taken appropriately and is still available, the models can be recreated with similar imaging software. Whether developed manually or with the aid of imaging software, 3-D models are developed essentially by working in opposition to how the initial scans were created. Scans are created by taking 3-D information from the patient and mapping it in 2-D slices. 3-D digital models are developed essentially by taking the 2-D information from the scans and reconstructing it back into three dimensions.

Case example:
More than ten years ago, there was a case involving a failure to diagnose a stroke-in-progress as a result of a dissecting aneurysm in the left vertebral artery. A patient entered a medical facility the Friday before a Memorial Weekend with signs and symptoms of a stroke-in-progress. A non-contrast CT was initially performed. As a CT without contrast would only be effective in showing areas of hemorrhage, evidence of the later diagnosed arterial dissection and occlusive strokes was not evident. The CT was followed by an order for an MRI to be emergently performed and interpreted. Delays in performing, reading, and interpreting the MRI due to the absence of all of the technicians over the Memorial Day weekend resulted in a severe delay in diagnosing a left vertebral artery dissection that lead to multiple devastating injuries to the brain stem, cerebellum, and thalamus as well as "locked in" syndrome.

The case eventually resulted with a dramatic recovery for the plaintiff, but without the benefit of modern graphics, presenting the case was quite challenging. The following are examples of modern graphics that could have been used in this case today to enhance the understanding and appreciation of the injuries by the jury:

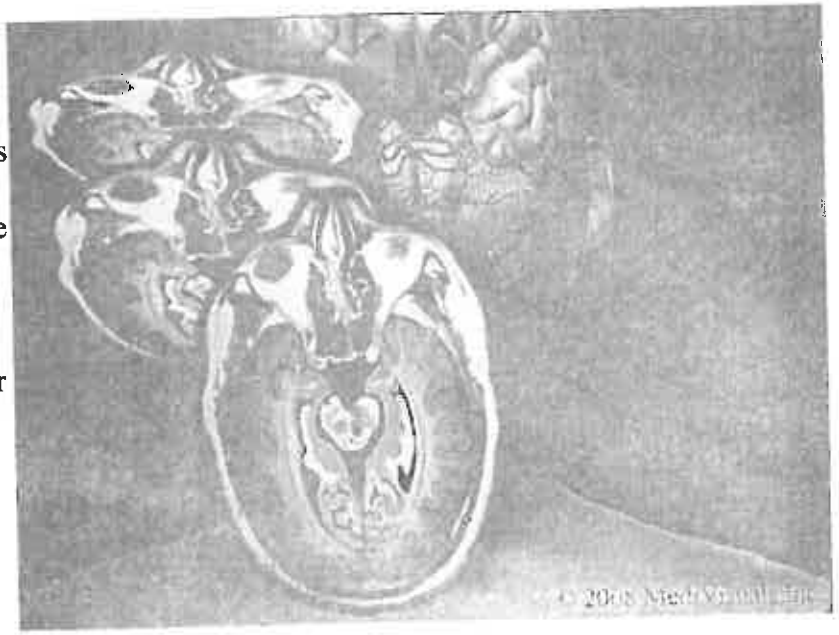


Animation sequences can be created to compare the arterial supply of the entire brain to the area of the brain supplied by the left vertebral artery. That area of the brain was severely affected by the failure to diagnose and promptly treat the left vertebral artery dissection.



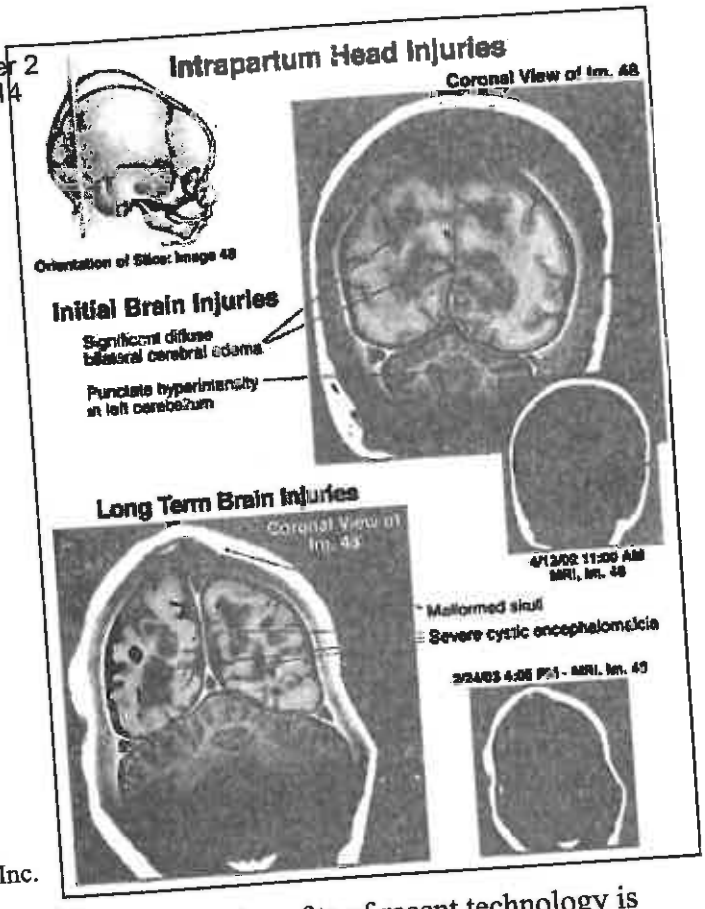
The dramatic and total occlusion of the left vertebral artery was particularly difficult for a lay audience to appreciate in the arteriogram. In order to emphasize the area of the brain that was affected by the obstruction, the plaintiffs arteriogram (A) can be digitally altered to show how it would have appeared without the obstruction (B). The arteriograms then can be transitioned into images that more clearly showed the arteries as well as the areas of the brain that are supplied by those arteries (C).

The MRIs that demonstrated the multiple, widespread areas of injuries were also difficult for laypersons to appreciate. To help communicate the severity and widespread nature of the injuries, the Scan Selector™ can be used. Three scans demonstrate the brain stem injuries, the cerebellar injuries, and the thalamus injuries. The brain stem injuries are shown here.

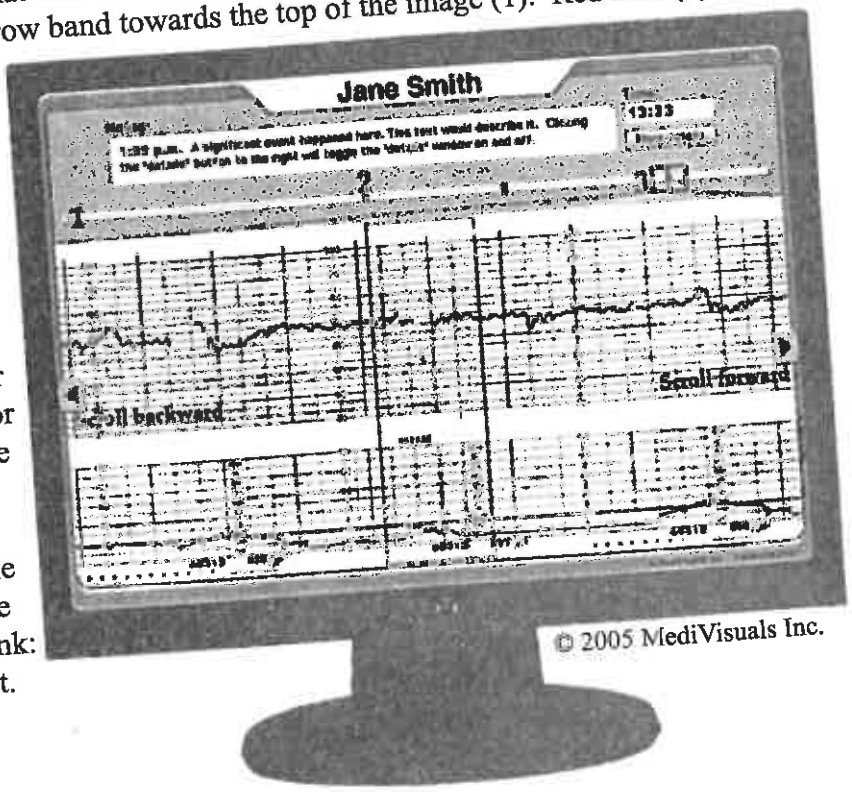


Birth Injuries

Brain injuries to infants around the time of delivery can also be dramatically demonstrated using similar techniques. The images shown here illustrate initial brain injuries related to an improper delivery and correlate them with the extensive loss of brain tissue evidenced in an MRI performed approximately one year later.



In the field of demonstrative evidence, one of the most effective benefits of recent technology is the ability to take lengthy and cumbersome fetal monitor strips and incorporate them into digital presentations. These digital fetal monitor strips allow the user to scroll across the strip, highlight certain key events that occurred at various times on the strip, and even create certain "hot buttons" that when selected bring up documents, illustrations, testimony excerpts, etc., to further enhance the events that took place at that moment on the strip. In the digital fetal monitor strip shown, the *entire strip* is seen as a narrow band towards the top of the image (1). Red bars (2) on the entire strip indicate when certain significant events took place. A black box with a highlighted area (3) on the strip indicates the portion of the strip that is enlarged as the main image. To scroll across the strip, the black box can be moved across the strip, thus changing what is seen as the enlarged portion. When a red bar on the strip is selected, various text or visuals can pop up to further enhance the explanation of the significant events that took place at that particular moment in time. A sample of a digital fetal monitor strip can be viewed by going to the following link: http://www.medivisuals.com.xohost.com/interactive/monitor_strip.htm



Animated Surgeries:

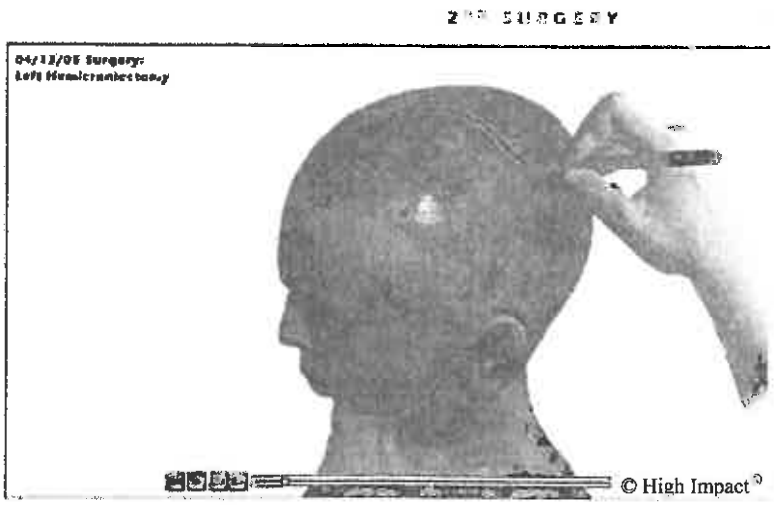
Proper foundation for surgical animations must be laid by the surgeon who performed the surgical procedure to establish that the animation will be useful to him or her in explaining the surgical procedure to the jury and that it is not offered to be a reproduction of a real time procedure. Animations are offered merely to compliment the physician's explanation of the surgery (just like still anatomical drawings, but they can be more effective in bringing about an understanding on the part of the jury and court). Counsel, experts, and judge should appreciate these facts before investing time and money in the development of the demonstrative aids.

Animating even a portion of a surgical procedure accurately is much more difficult than accurately demonstrating it in a series of still images simply because it is easier to accurately recreate several individual moments in time than it is to show a full sequence of events as they occurred in the correct order and with accurate timing. Also, because surgical dissections are almost always slow and tedious, precise accuracy of even small portions of a surgical procedure would result in a long, drawn out, boring, and very expensive demonstrative aid.

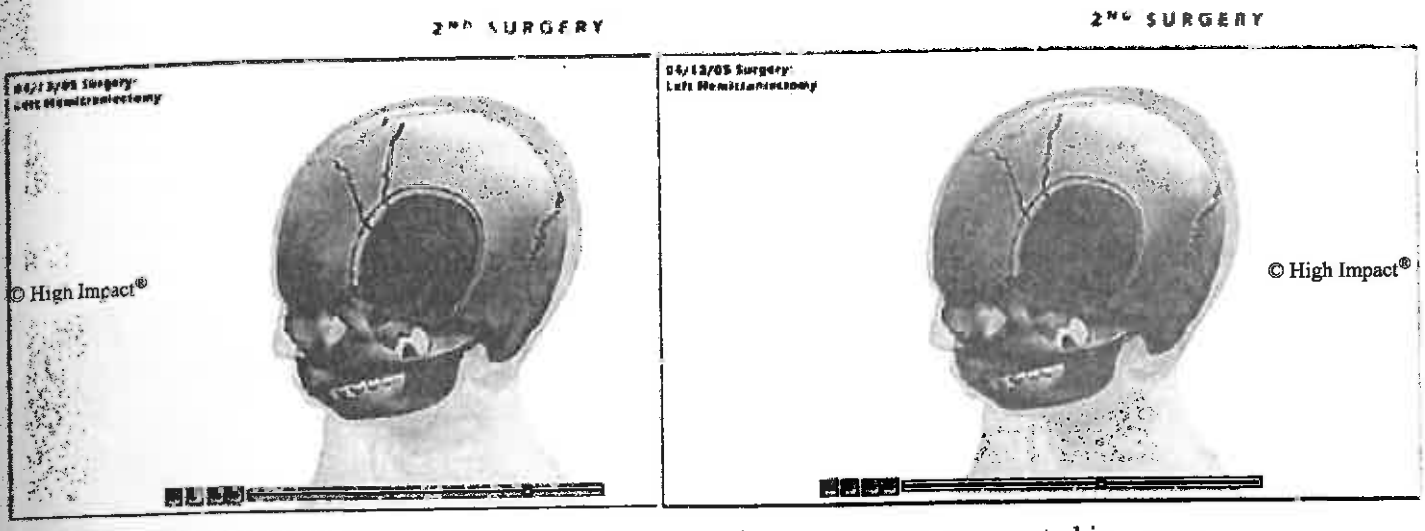
The animation sequences related to these injuries and surgery can be viewed at the following link: http://www.medivisuals.com/content/animations/craniotomy_vid.html

Other effective animation sequences to show brain injuries and surgical interventions include a series developed to show intracranial hemorrhages and a series of decompressive surgical procedures. In this case, a dramatic recovery was once again achieved.

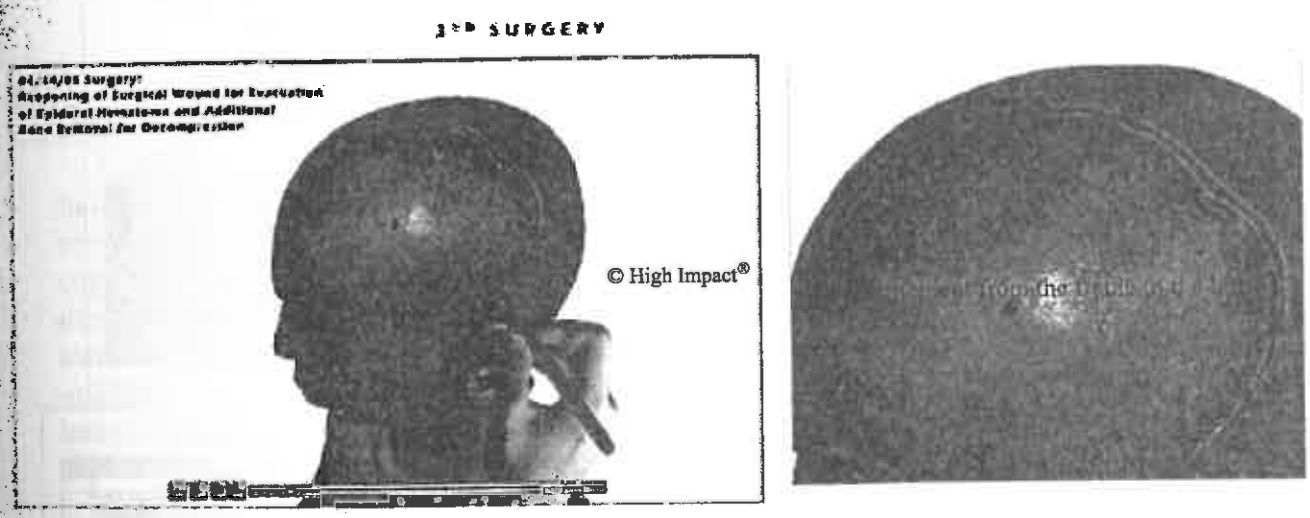
The following animation sequence was produced by High Impact®.



The combination of a photographic reference and graphics consistent with a likeness of the patient evokes sympathy and sets the stage for subsequent animation sequences.



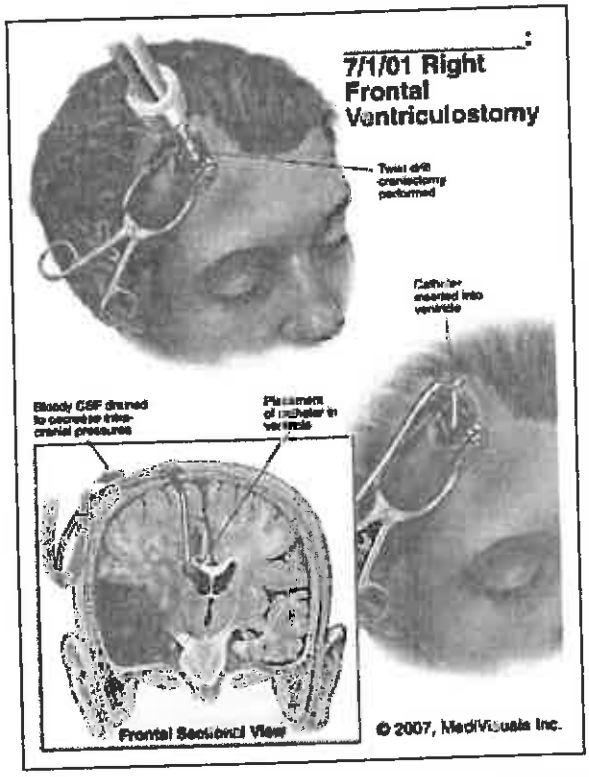
Upon incision and reflection of the skin, the internal structures are represented in a more graphic style.

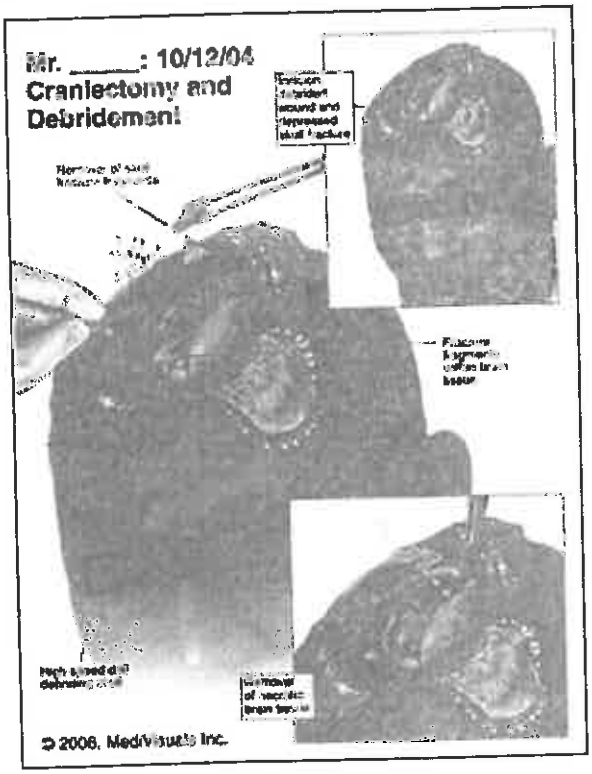


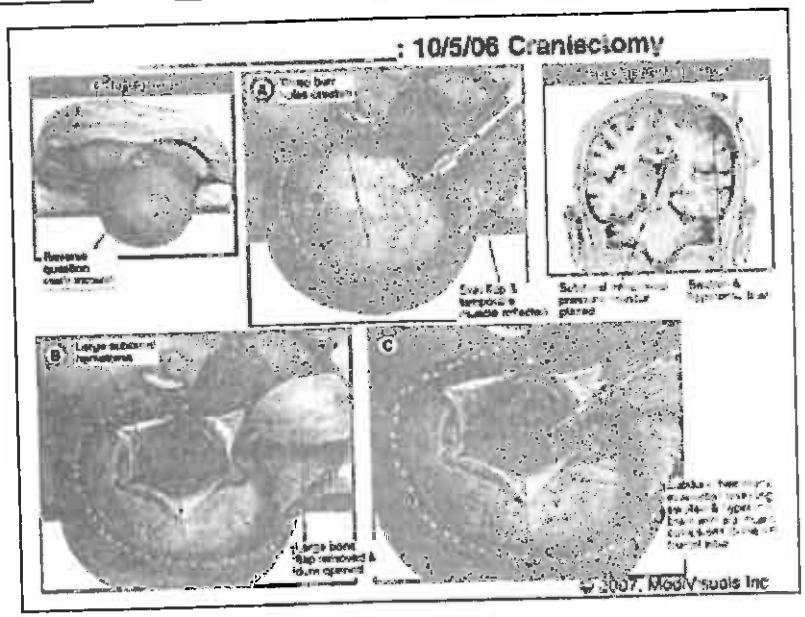
Because of recurrent bleeding, surgical evacuations had to be repeated several times and each evacuation was animated. As evidence of the previously stated fact that animations are offered merely to compliment the physician's explanation of the surgery and need not be precisely accurate, it is worth noting that certain inconsistencies in the animation did not interfere with its effectiveness. For example, in the animation sequences showing the recreation of the initial skin flap, rather than showing the staples removed in the photographic reference prior to the flap being once again lifted, the creation of a new incision line is shown outside the previous incision line (above).

Illustrated Surgeries:

Whether animated or developed as still images for digital presentations or exhibit panels, demonstrative aids demonstrating the invasive surgical procedures necessary to address the initial, life-threatening intracranial injuries are very impressive. Demonstrative aids in combination with effective testimony involving surgical procedures such as placements of ICP monitors, ventriculostomy tubes, craniotomies and/or craniectomies can prove very effective.

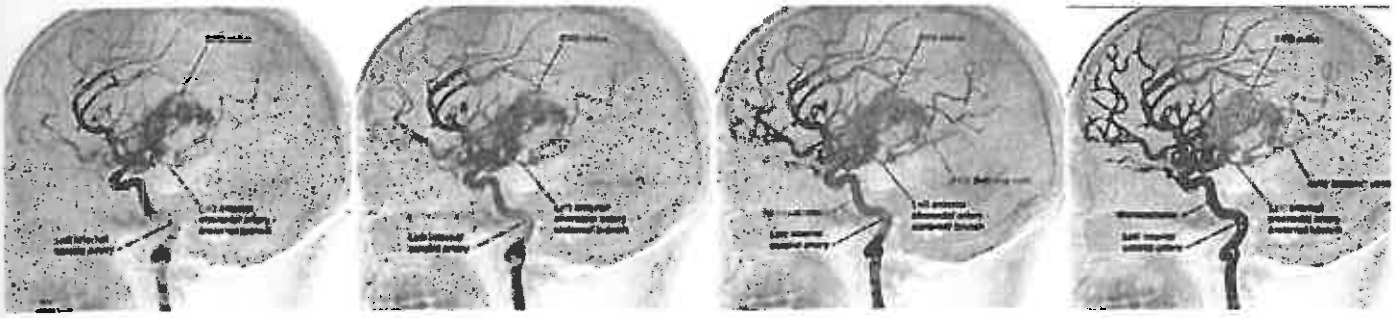






Even in light of all the new developments in technology and presentation techniques, traditional exhibit panels remain the mainstay in most practices. The soundest arguments in support of the use of exhibit panels over various digital presentation techniques continue to be that (1) exhibit panels do not malfunction and (2) exhibit panels can be left up around the courtroom for extended periods of time, as compared to digital presentations that are only visible for the moments when they are addressed in the presentation. In addition, tissues are generally rendered more realistically in still illustrations than in animations.

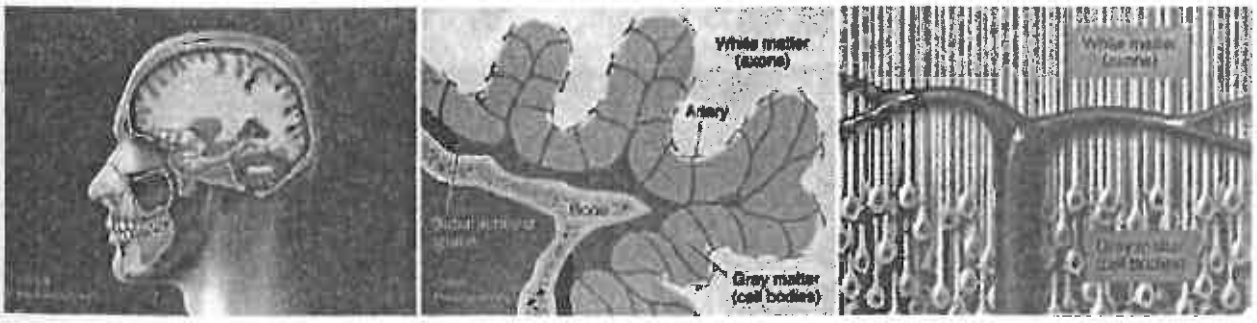
When using still images in digital presentations, the images do not need to be static. Small animations can be developed that add interest and effectiveness to the images' use. These animations can begin with an overall view of an exhibit panel with multiple illustrations, then zoom into individual illustrations and pan around the exhibit panel to ultimately view all of the illustrations up close. Dissolve animations (seen below) can be used to transition from a scan to an illustration clarifying the findings of the scan.



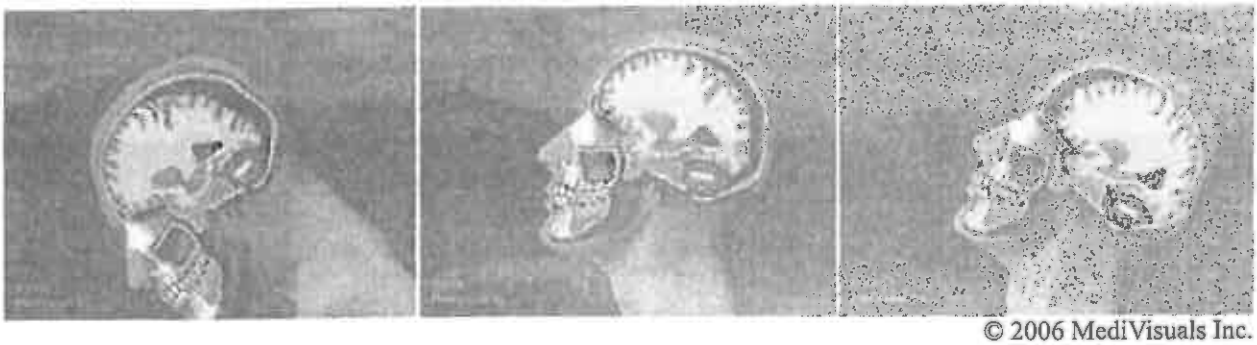
Demonstrative Evidence in Cases with Negative Imaging Studies

In cases in which imaging studies fail to demonstrate brain injury, demonstrative evidence is even more important. In these cases, the demonstrative aids focus more on the behavioral or cognitive changes exhibited by the plaintiff following the incident. One of the most effective demonstrative aids for the less severe brain injury available today is the "Mild TBI" animation series developed by MediVisuals. These animation sequences effectively communicate how injuries to the brain can occur that result in neurocognitive deficits — even with negative imaging studies and without evidence of a blow to the head. These animation sequences can be viewed at the following link: http://www.medivisuals.com/content/animations/mtbi.html

The animation sequences show the relevant anatomy from gross anatomy to microscopic.



The animations also show how the soft brain impacts on the inside of the skull during sudden deceleration or acceleration injuries, causing shock waves that travel throughout the brain to result in multiple, widespread microscopic injuries.

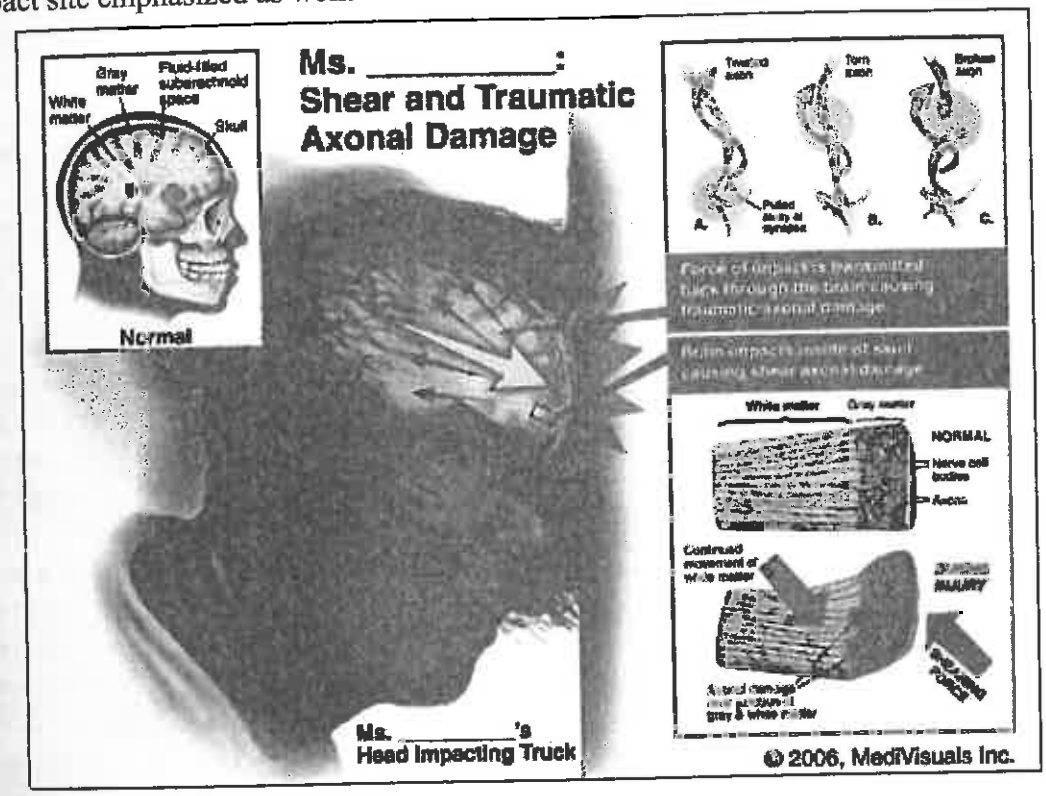


Other animations sequences show in greater magnification how the brain impacts along the hard and sharp inner surfaces of the skull during a sudden deceleration injury.

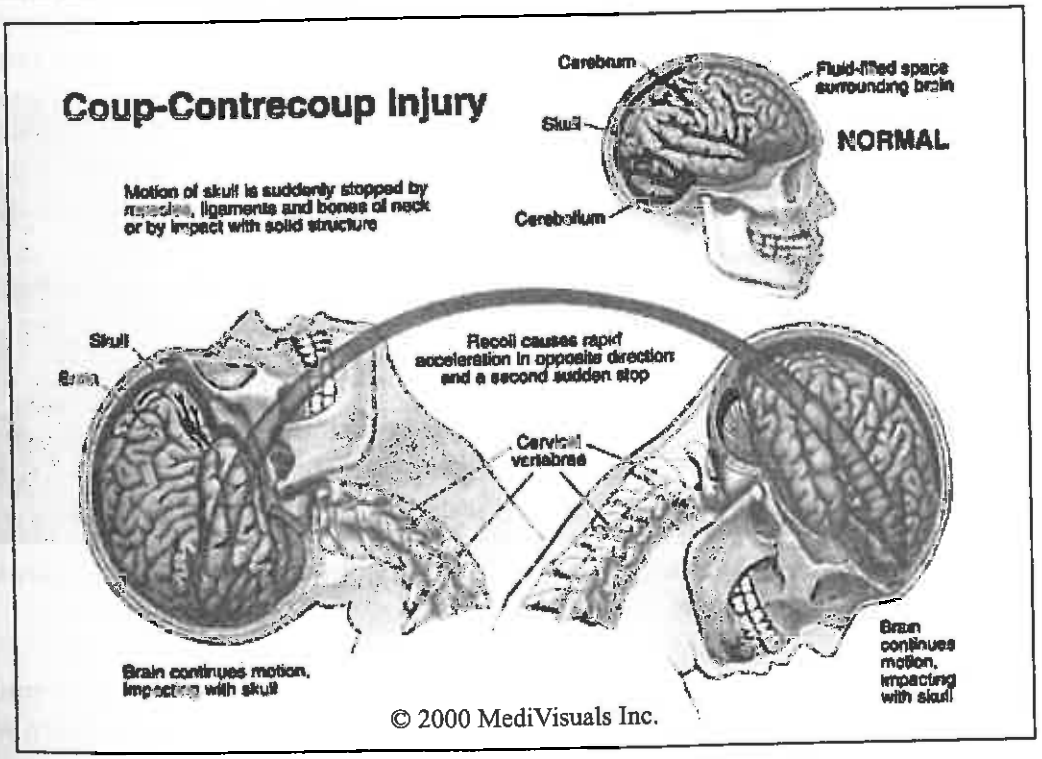
Other animation sequences show how injuries to the small friable, axons occur during sudden acceleration and/or deceleration injuries. At the same time, the animations sequences show that because the blood vessels are larger and more resilient, they may not be injured. These sequences are particularly effective in helping to explain how, that even though no lesions may be evident on imaging studies (because MRIs detect areas of hemorrhaging instead of axonal shearing), devastating injuries can still be present.

The animation sequences can be altered to be made more case specific, or case specific exhibits can be used in conjunction with the animation to show a plaintiff's specific head injury and related trauma.

In those cases where a definite head impact is involved, the location of the impact is emphasized in whatever demonstrative aids may be developed, often with the relationship of the underlying brain to the impact site emphasized as well.

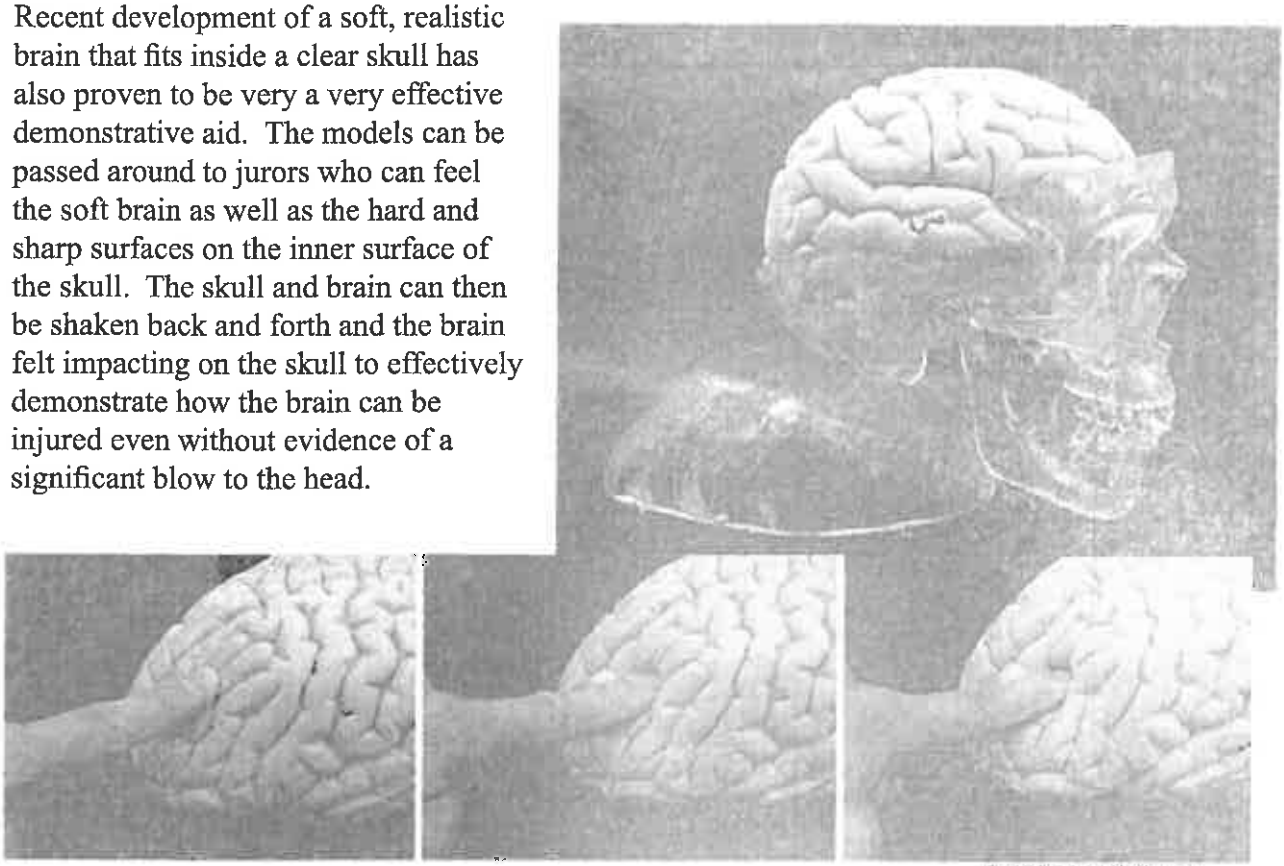


In cases where no definitive head impact is involved, exhibits demonstrating the violent back-and-forth or side-to-side (contrecoup) type movements of the head and neck during trauma are used. These exhibits focus on sudden changes in motion resulting in the brain impacting on the inside of the skull.

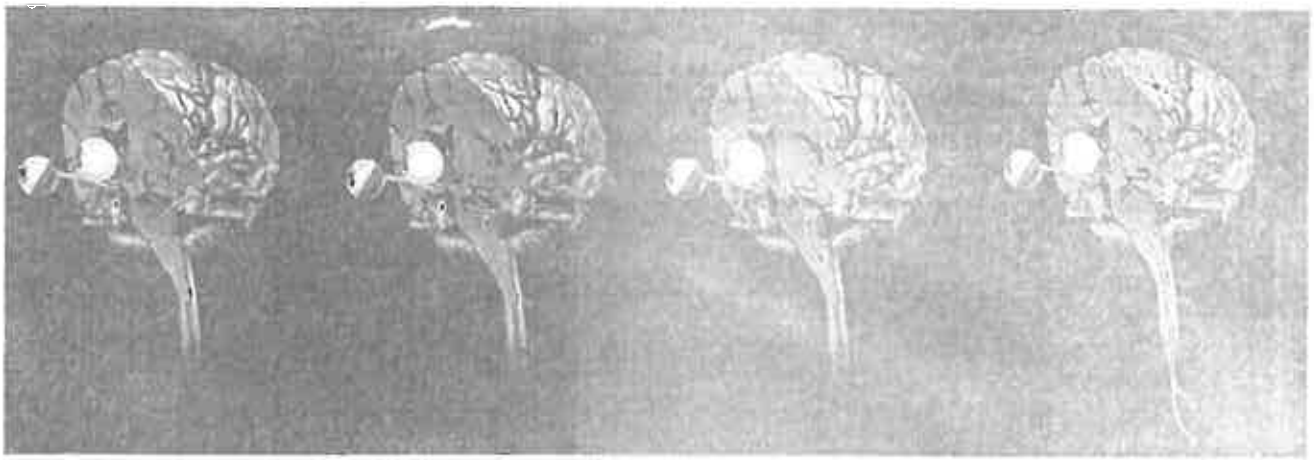


MediVisuals "Soft Brain and Clear Skull" Model Set

Recent development of a soft, realistic brain that fits inside a clear skull has also proven to be very a very effective demonstrative aid. The models can be passed around to jurors who can feel the soft brain as well as the hard and sharp surfaces on the inner surface of the skull. The skull and brain can then be shaken back and forth and the brain felt impacting on the skull to effectively demonstrate how the brain can be injured even without evidence of a significant blow to the head.



Neural Pathways Animations



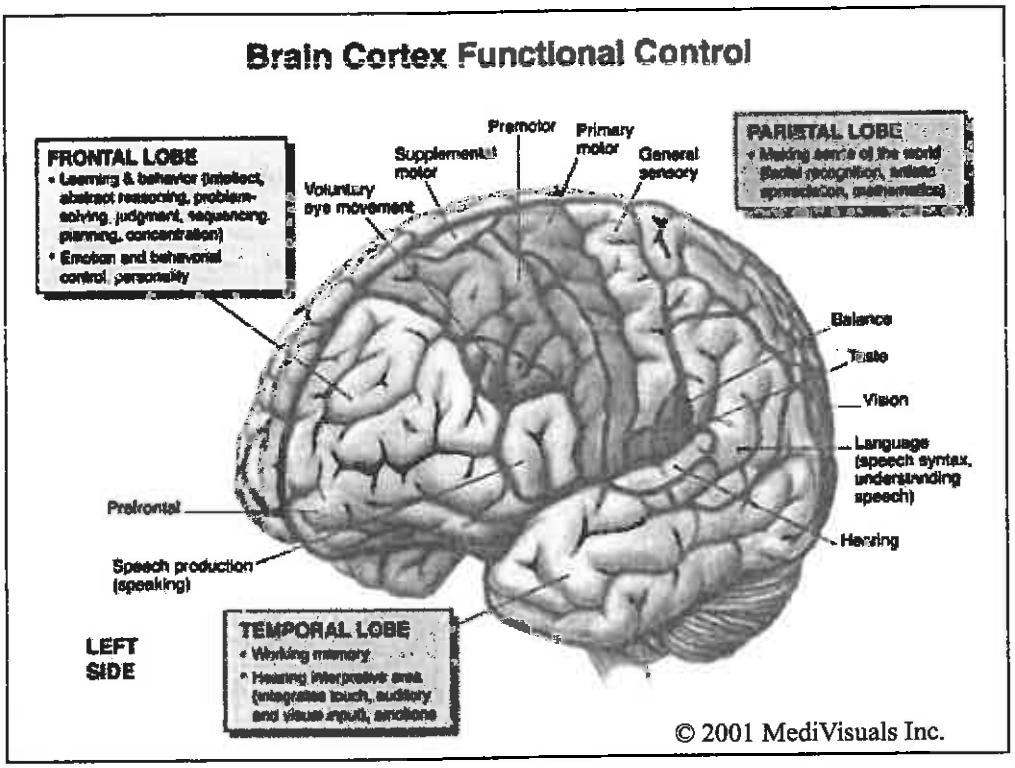
These neural pathways animations can be viewed at the following link:
http://www.medivismedia.com/richmond/JD/NeurologicalPathways.mov

The neural pathways animation sequences demonstrate the general pathways that impulses must travel in order to perform certain functions such as repeating a written or heard word,

maintaining balance, eye motor control, etc. The purpose of the animations is to help correlate neurological deficits with a traumatic event by helping experts to explain how disruption of axons (as a result of a traumatic event) anywhere along these pathways can result in interference with the injured person to effectively perform those tasks.

Behavioral / Neuropsychological Deficits

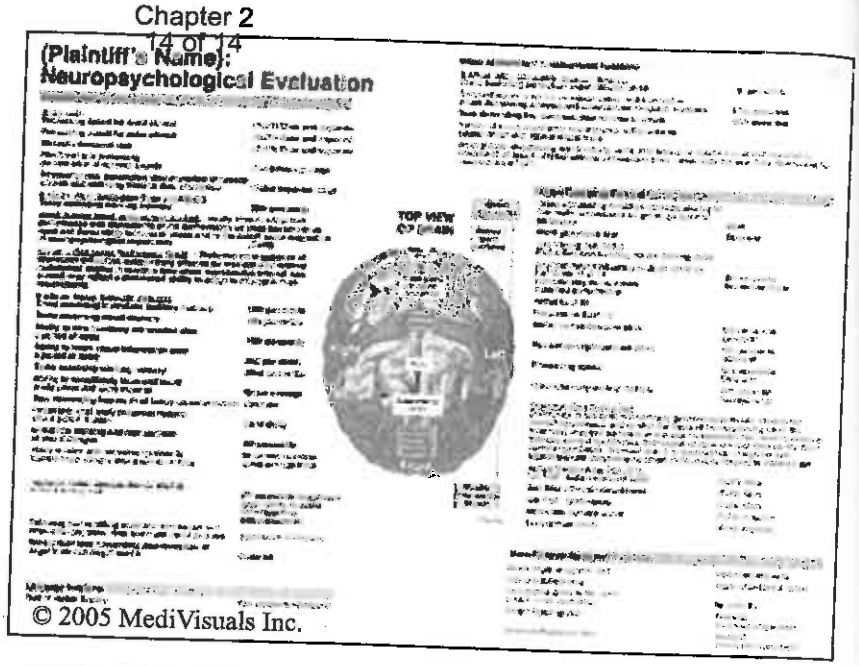
Explaining brain function is an essential part of presenting a traumatic brain injury case. The emphasis in explaining brain functional control is to correlate the areas of the brain that control various functions with the areas of deficits demonstrated in the plaintiff. For example, in most frontal impact or sudden deceleration injuries, the frontal and temporal lobes impact on the inside of the skull and sustain the greatest injuries. Also in these types of injuries, plaintiffs exhibit difficulty with memory (temporal lobe) and personality changes (frontal lobe). There are numerous brain functional charts available that demonstrate functional control. Care should be taken in selecting a preexisting chart or developing a new chart that emphasizes the areas of the plaintiff's brain injury best, and correlates them with the resulting neurological deficits.

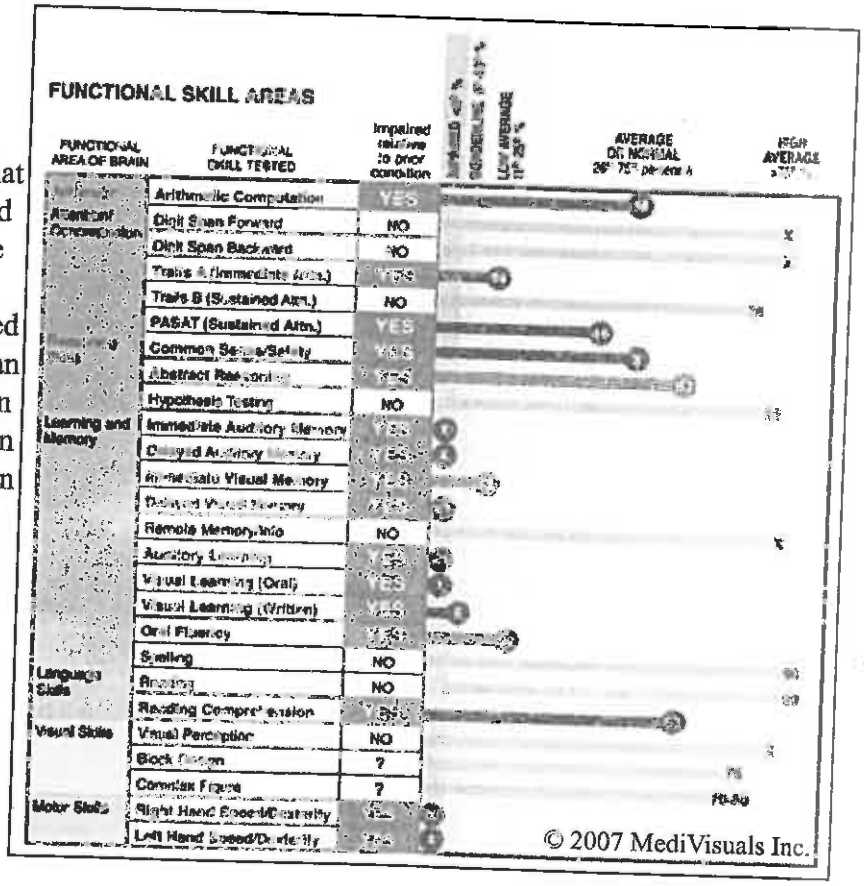


With or without definitive head impact, in cases involving traumatic brain injury that are not supported by positive imaging studies, it is essential to emphasize the plaintiff's behavioral or cognitive changes following the collision. These are based upon documented findings described by family members or those who have had close relationships with the plaintiff both before and after the incident. They are also based upon neuropsychological evaluations. These demonstrative aids are developed to emphasize the subjective findings of those closely associated with the plaintiff, while other aids are developed to emphasize the more objective findings revealed in neuropsychological evaluations.

Neuropsychological Charts

Charts developed to summarize the somewhat lengthy and complicated neuropsychological evaluations can be developed with either detailed or simplified approaches. Typically, the test results are indicated and color coded to correlate with the area of the brain associated with the specific tests. Abnormal test findings are often indicated with red type. In evaluations where there are limited abnormalities, the ability to read the text is important. In other cases, the brain function abnormalities may be so widespread that the necessity to read the text is not that important; the mere volume of red text demonstrates the significance of the abnormal brain function. These charts can also be developed as interactive digital charts that can be scrolled across and have certain "hot areas" that when clicked upon will provide additional information regarding the study.





Conclusion:

As evidenced in this presentation, much has been accomplished in the fields of medical illustration and graphics which offers a level of demonstrative assistance not previously available. Brain injury cases certainly deserve the use of the best demonstrative aids available. Their use can make all the difference in obtaining a just recovery, whether for the purpose of demonstrating catastrophic brain injuries and invasive surgeries or, in the case of less severe traumatic brain injuries, to help explain how brain injuries occurred and are present even when diagnostic studies fail to show the injuries.