the SPINAL COLUMN

Life is better when you're aligned.

JANUARY 2025

The Spine-Mind Connection

How Upper Cervical Care Enhances Mental Clarity

As we enter a new year, it's the perfect time to focus on holistic health and well-being. Many people set goals for better physical fitness or stress management, but have you considered how your spinal health might be affecting your mental clarity and emotional balance? At the core of this connection is the upper cervical spine - a small but powerful area that can significantly impact your brain and nervous system.

The Upper Cervical Spine: A Gateway to Mental Wellness

The upper cervical spine comprises *the atlas (C1) and axis (C2),* the top two vertebrae in your neck. These structures support the head and allow for its wide range of motion, but they also play a critical role in protecting the brainstem - a key part of the nervous system that regulates essential functions like breathing, heartbeat, and sleep.

When these vertebrae are misaligned, even slightly, it can *disrupt the communication pathways between your brain and body.* This misalignment, often called a subluxation, can cause nerve interference, reduced blood flow, and increased pressure on the brainstem. The results? Foggy thinking, mood swings, difficulty focusing, and even heightened feelings of anxiety or depression.

Scientific Insights into the Spine-Mind Connection

Recent research supports the role of chiropractic care in improving mental health. A study published in *The Journal of Upper Cervical Chiropractic Research* found that patients who received upper cervical adjustments reported significant improvements in their overall quality of life, including better mood, increased energy, and reduced stress.

How Spinal Alignment Affects Mental Clarity

1. **Improved Blood Flow to the Brain.** Proper spinal alignment ensures optimal blood flow and oxygen delivery to the brain.
2. **Reduced Stress and Nervous System Overload.** The nervous system is your body's command center, and it thrives on clear communication between the brain and body.
3. **Boosted Mood Through Hormonal Balance.** The brainstem influences the release of hormones like serotonin and dopamine, which regulate mood and feelings of well-being.

Signs You Might Need Upper Cervical Care

How do you know if your upper cervical spine might be affecting your mental clarity? *Look for these common symptoms:*

- **Persistent brain fog or difficulty concentrating**
- **Mood swings or increased irritability**
- **Frequent headaches or migraines**
- **Poor sleep quality or insomnia**
- **Unexplained fatigue or low energy**

If these symptoms sound familiar, an evaluation can help pinpoint whether misalignments are contributing to these issues.

The Benefits of Starting Upper Cervical Care

The start of a new year is an ideal time to address the underlying issues that may be holding you back from achieving your goals.

Here are just a few benefits you may experience:

- **Enhanced Focus:** Improved brain-body communication sharpens your ability to concentrate and process information.
- **Elevated Mood:** Balanced nervous system function promotes emotional stability and resilience.
- **Reduced Stress:** A properly aligned spine supports your body's ability to adapt to life's challenges.
- **Better Sleep:** Restoring alignment often alleviates sleep disturbances, helping you wake up refreshed.

Whether you're striving for improved productivity at work, better stress management, or enhanced overall wellness, upper cervical care offers a natural, non-invasive solution.

As you embrace 2025, consider how a healthy spine can unlock a sharper, brighter version of yourself. Let us help you align your goals, your health, and your future. Here's to a focused, fulfilling year ahead!

Upper Cervical Chiropractic corrections are a holistic solution to help maintain *Mental Clarity.*

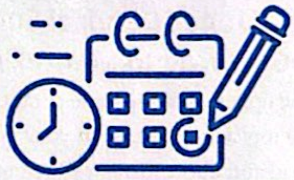
Call and schedule an appointment today!

Scan for REFERENCES

What's Next?

The next step is to schedule an appointment.

Our team will be happy to answer all your questions and help you decide if this is the right path for you.



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Review Article

EPIC Spinal Procedure with Sound Wave Technology Induces Biomechanical Alignment Putatively Influencing Pain Response

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Abstract

Spinal biomechanical alignment is now able to be altered through the use of unique sound wave technology. This methodological commentary will correlate recent studies demonstrating the ability of sound waves to carry mass, how the EPIC technique spinal procedure uses a sound wave impulse to create measurable changes in spinal alignment, and the clinical safety and efficacy of this approach. The EPIC technique is a direct genealogical descendant of the technique originally developed by the founding family of chiropractic. With sound wave therapies currently being used to break up kidney stones, called lithotripsy, in physical therapy for the treatment of soft tissue injuries, in the treatment of prostate cancer, and in the treatment of Alzheimer's disease, it is possible that the use of sound wave therapies may enter into the realm of altering joint biomechanics. Through a neurovascular examination, the EPIC technique spinal procedure can ascertain the presence of craniocervical subluxation, followed by acquiring multi-dimensional radiographic images for structural analysis. Currently using digital radiographic analysis, the EPIC technique acquires an epigenetic profile of structural asymmetries as well as a multi-directional biomechanical malposition profile of the spine, combining both profiles to ascertain the exact degrees for realignment. EPIC clinics have successfully utilized EPIC on over 20,000 cases. Comparison of pre-treatment biomechanical lateral displacement of the C1 vertebra around the Z-axis measured on digital radiographs, and post-treatment biomechanical lateral displacement of the C1 vertebra measured on digital radiographs immediately following the procedure, demonstrated an average 52% reduction in lateral biomechanical displacement around the Z-axis in a select group of over 2,000 cases. While more research is required, we are encouraged by these preliminary results. WC 265

Keywords: EPIC, Spine, Pain, Global health, History of subluxation, Chiropractic, Sound wave technology and biomechanical alignment, Craniocervical, Subluxation, Neck Pain

Introduction

History of Subluxation

Inside the chiropractic profession, there are many diverse procedures and approaches to spinal care. Although each individual Doctor of Chiropractic (DC) may practice chiropractic with their own individual systems and techniques of care, those procedures are rooted in established techniques taught in the curriculum of various chiropractic colleges and universities. One of those established techniques is called EPIC. "EPIC" is an acronym for Evolutionary Percussive Instrument Corrections. It is a chiropractic technique that focuses on the use of progressively advancing diagnostic and adjusting technology to correct the craniocervical junction alignment [1].

The EPIC technique is a direct ancestor of the technique originally created by the founding family of chiropractic. Daniel David Palmer, DC, discovered and defined spinal "subluxation" in 1895 as a condition of the spine in which a vertebra has lost its proper juxtaposition to the point of impairing the function of the nervous system. Bartlett Joshua Palmer, DC, Daniel David Palmer's son, spent a lifetime of chiropractic research and came to the conclusion that the primary direction of the nervous system's flow is from the brain, down the spinal cord, and out the nerves to the affected/controlled areas. This concept is known as ADIO (Above-Down-Inside-Out). Based upon this concept, Bartlett Palmer developed the Hole-In-One (HIO)/Toggle technique in the early 1900s, which focused on evaluating and treating the two upper cervical vertebral misalignments in an area that he called "the true subluxation [2]." The presence of the subluxation's neurologic imbalance was established through neurophysical examination.

Subluxation Details for Adjustment

The direction of atlas (C1) malposition was determined by radiographic evaluation and was defined through positional listings (i.e., Atlas Superior Left Posterior (ASLP), Atlas Inferior Right Posterior (AIRP), etc.) to give the chiropractor a general understanding of which way to adjust it. The axis (C2) malposition was given a different general designation from the radiographs and needed a separate adjustment. The neurophysical criteria were reviewed after the adjustment to evaluate any changes, but it was not considered standard practice to take post-adjustment radiographs.

Palmer's approach was the foundation of the science, results, and public perspective of the beginning of the chiropractic profession and was called the Toggle technique. In the 1930s, John Grostic, DC, improved the radiographs and calculated angles used to evaluate cervical malposition and quantified these malpositioned vertebrae on a mathematical engineering platform standardizing the use of post-adjustment radiographs [3]. In the 1970s, Roy Sweat, DC, developed a 2-axis, table-mounted, adjusting instrument that could deliver a percussive soundwave to align the upper cervical spine [3]. In 2001, the lead author, Stan Pierce, DC, and his father, Stan Pierce Sr., DC, advanced and refined the radiographic analysis protocol to include data transposition between radiographs for anatomical clarity, methods to validate reference line determination and measurement accuracy, and evaluation methods to determine genetic abnormalities that would affect the understanding of each patient's "normal" position into which they needed to be adjusted [4]. This technique was known as the Advanced Orthogonal technique, involving streamlined imaging analysis to assist in removing analysis errors through advanced software coding [5]. In 2015, Stan Pierce, DC and his technique board rebranded the technique to Evolutionary Percussive Instrument Corrections (EPIC), further enhanced the analysis of the epigenetic profile, refined biomechanical influences, and created a statistical standardization of care. EPIC also created patented laser targeting and invented the first 3-axis percussive adjusting instrument, thus enabling the unique ability to purely calibrate the percussive adjusting force to match the axis of vertebral malposition.

Sound Waves in Spinal Care: A Historical Perspective

In 2015, scientists from the Department of Mechanical Engineering at the University of Bristol provided the first demonstration of the ability to levitate and manipulate multiple objects simultaneously through the use of sound. This led them to surmise that, in the near future, surgeons may use "acoustic tweezers" to trap and manipulate selected objects within tissue [6].

In 2019, researchers at the University of Oregon published an article in Physical Review Letters titled "Gravitational Mass Carried by Sound Waves" in which they show that sound waves do carry mass – in particular, gravitational mass [7].

In 2020, researchers at the Institute of Theoretical Science and at the University of Oregon published an article in Physical Review Research titled "Sound waves move matter" where they consider a wave packet moving in the Z direction with an amplitude that is independent of the X and Y. They analyze that at second order in an expansion around small-amplitude vibrations, there is a small net motion of material, and thus mass, that is generated as a straightforward consequence of Newton's laws [8].

With sound wave therapies currently being used to break up kidney stones, called lithotripsy, in physical therapy for the treatment of soft tissue injuries, in the treatment of prostate cancer [9], and in the treatment of Alzheimer's disease [10], it is possible that the use of sound wave therapies may enter into the realm of altering joint biomechanics.

The EPIC technique spinal procedure is an approach in the spinal care industry that utilizes sound wave treatment technology to alter the biomechanical alignment of the craniocervical junction. The protocols of the EPIC technique spinal procedure were published in 2021 [5,11]. Whereas abnormal biomechanical spinal alignment (aka. spinal subluxation) in the craniocervical region has been correlated to altering neurologic dysafferentation and cranial hemodynamics, this craniocervical subluxation has the potential to directly and/or indirectly contribute to the possible negative sequelae of many different conditions. Many pain syndromes are a direct and/or indirect effect of an uncorrected craniocervical subluxation.

Descriptive of Biomechanical Alignment Using Sound Wave Technology from The Epic Technique Spinal Procedure

Through a neurovascular examination, the EPIC technique spinal procedure can ascertain the presence of craniocervical subluxation, followed by acquiring multi-dimensional radiographic images for structural analysis. Using digital radiographic analysis, the EPIC technique acquires an epigenetic profile of structural asymmetries as well as a multi-directional biomechanical malposition profile of the spine, combining both profiles to ascertain the exact degrees for realignment. These coordinates are then calibrated into the Integrity Genesis instrument, an FDA-registered 3-axis sound impulse generator device (Figure 1), by angulating the instrument on the calculated coordinates, aka "vectors.

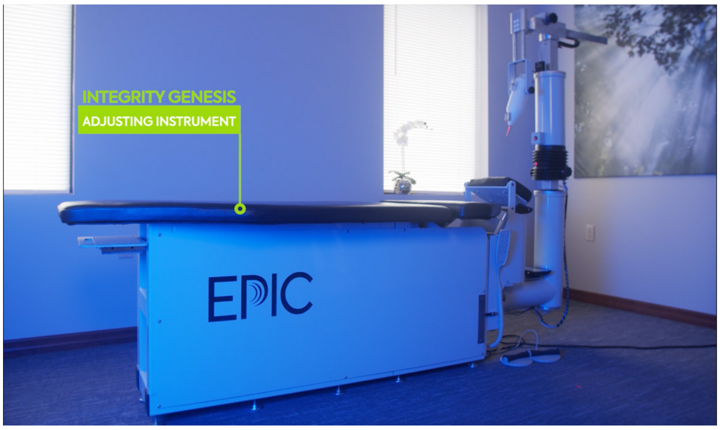

Figure 1: By angulating the instrument on the calculated coordinates, aka "vectors."

The instrument stylus is targeted just off the skin over the C_1 cervical transverse process (Figures 2,3). The device is activated to initiate an electromagnetic solenoid to strike the stylus on the opposing end, transferring the motion energy into a compressive wave that travels down the stylus and releases as an instantaneous sound impulse. With the cervical vertebral transverse process being at an average minimum depth of ¾"-1", there is no direct contact between the stylus and the vertebra. Any force transmission would have to travel through approximately 1" of soft tissue to affect the osseous structure.

Figure 2: Demonstrates the position of the Integrity Genesis stylus just off the skin.

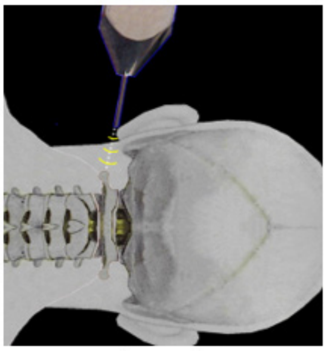

Figure 3: Demonstrates the angulated targeting of the stylus for the sound wave impulse to reach the C1 vertebra at its location 1” deep on the correct coordinates.

Acoustic force generation of the Integrity Genesis instrument was measured using ARTVIS (Acoustic Real-time Video Imaging System) technology. ARTVIS diagnostics reveal the force generation of the Integrity Genesis instrument generates 61.5dBa at 2.5kHz, traveling at a speed of 345.8m/s. (Figure 4) at the 1” depth from the stylus.

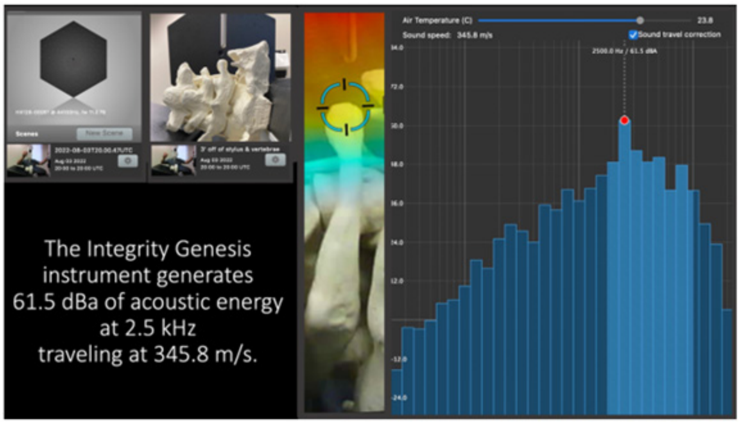

Figure 4:

A digital force evaluation performed with a linear accelerometer (aka “testing agent”) was set at 1” from the stylus tip. It revealed that when the stylus of the Integrity Genesis instrument was aimed directly over the testing agent, it generated a Z-axis linear force of .02 m/s2 acceleration and a cumulative linear force of .07-.08 m/s2 (Figure 3). The sequence of 5 measured strikes in (Figure 5) from correlating instrument positions in (Figure 6) demonstrates a 100% increase in Z-axis force as well as total generated motion on strikes 1 and 5 when the instrument was placed over the testing agent on the headpiece, compared to strikes 2, 3, and 4 having the instrument turned counter-clockwise 90 degrees away from the testing agent (strike 2), clockwise 90 degrees from the testing agent (strike 3), and the opposite direction from the testing agent (strike 4).

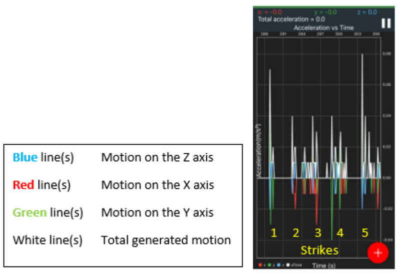

Figure 5:

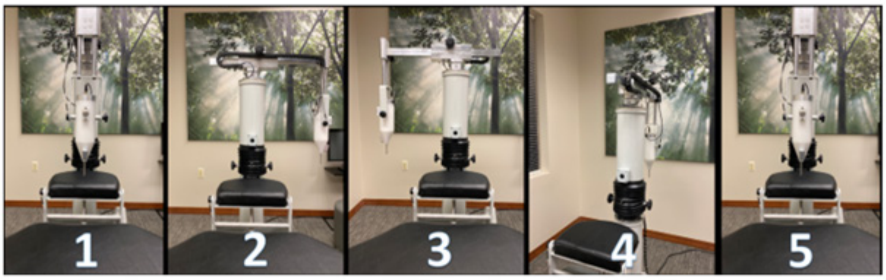

Figure 6:

It should be noted that it was reported in an article in Arthritis Rheumatology in 2007, that the coefficient of friction of cartilage surfaces in a diarthrodial synovial joint (as is the craniocervical junction) is only 0.001μ [12].

With researchers White and Panjabi noting that the maximum lateral displacement of the top cervical vertebra is only approximately 1/8” [13], it is therefore feasible to consider that a linear acceleration force generated by the mass displacement of a sound wave generated by the Integrity Genesis solenoid strike could be enough force to create a movement of the vertebra, resulting in a reduction of the biomechanical displacement. It is also feasible that a specific degree of application of this linear force displacement could create an inverse movement of the cervical vertebra to cause a directional reduction of the biomechanical malposition.

With the craniocervical junction of the spine having such a low coefficient of friction and with minimal distance of displacement, the use of a sound wave impulse applied to accurate coordinate settings can provide adequate mass displacement in a predictable opposing direction to gently reposition the structural alignment. As the EPIC technique spinal procedure is the only procedure that calibrates the sound wave delivery on the exact axis of craniocervical misalignment using the Integrity Genesis 3-axis instrument, and in that these coordinates are customized based on the epigenetic and misalignment profiles of each patient, the accuracy of this treatment may have a more effective outcome than general approaches. The EPIC technique spinal procedure has been performed in thousands of cases with measurable improvements in biomechanical alignment viewed on comparable digital radiographs in every case [5].

Safety and Efficacy

With the EPIC technique, spinal procedures are performed in the spinal joint’s normal range of motion using a low-amplitude, non-contact force. This allows for optimal preservation of the soft tissue and neurovasculature integrity of the craniocervical region.

A comparison of pre-treatment biomechanical lateral displacement of the C1 vertebra around the Z axis measured on digital radiographs and post-treatment biomechanical lateral displacement of the C1 vertebra measured on digital radiographs immediately following the procedure, demonstrated an average 52% reduction in lateral biomechanical displacement around the Z-axis in a select group of over 2,000 cases. Improvements in the associated neurovascular dysfunctions and symptomatology were seen in each of these cases following EPIC treatment.

The relevance of an average 52% reduction on pain reduction can be noted in a study published in the Journal of Canadian Chiropractic Association in 2009 reporting on 309 consecutive case files treated with craniocervical procedures. 192 cases cited a chief complaint of low back pain, and 49 cases cited having a combination of neck pain, mid back pain, low back pain, extremity pain, and headache. 66 cases met the inclusion and exclusion criteria for the study and were evaluated for comparative neck pain Numerical Rating System (NRS) and Neck Disability Index (NDI). The average reduction in C1 laterality was 48% which was correlated with a 70.1% reduction in NRS and a 59.2% improvement in the NDI within the first 2 weeks following the initial treatment. Additionally, no serious adverse events occurred [14].

It is also worth noting that the biomechanical reductions from the Integrity Genesis sound wave impulse were equally effective even when the angular targeting to the C1 vertebral transverse process required the force to be sent through the mastoid process or ear cartilage (Figure 7), and at all various customized angles measured from each patient’s radiographic analysis, including Z impulse vectors over 50 degrees and even <0 degree Z vector settings.

A simple schematic (Figure 8) is presented herein to help explain EPIC for comprehension purposes.

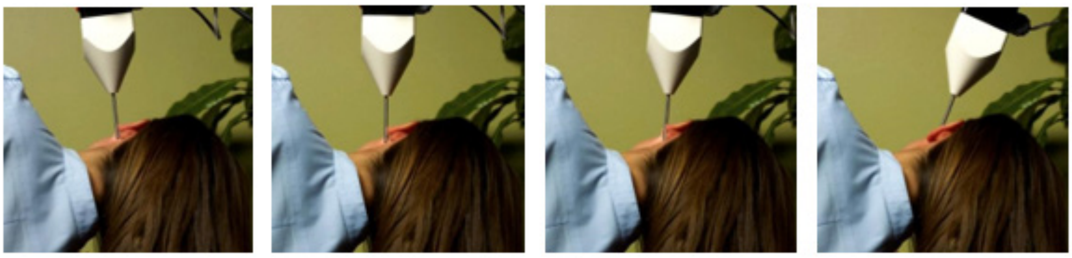

Figure 7:

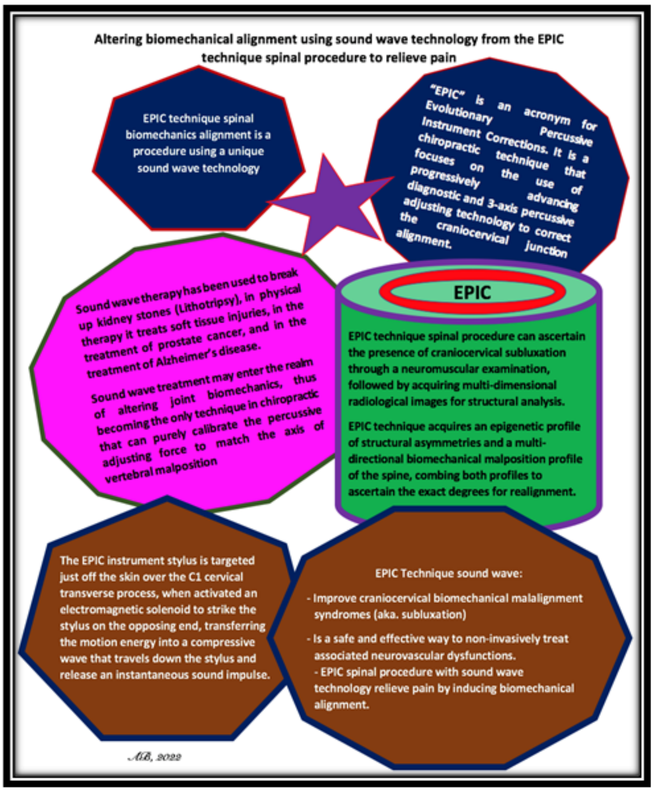

Figure 8:

Limitations

While this article is primarily descriptive in terms of the methodology of this novel EPIC technological platform, the efficacy of this technique requires additional rigorous RCT experiments in a large, generalized disordered cohort study across multiple clinics. Until this required research is accomplished, we herein are cognizant of this pitfall, and as such, any interpretation must be met with a cautionary note.

Conclusion

The use of the EPIC technique sound wave spinal procedure to improve craniocervical biomechanical malalignment syndromes (aka. spinal subluxations) is a safe and effective way to non-invasively treat associated neurovascular dysfunctions and pain syndromes. It is likely that future research will reveal additional correlations and opportunities for the use of sound wave treatment procedures in the spinal health care space.

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Co-inventor of the Integrity Genesis is Kelcey Wiginton, DC. ARTVIS diagnostics was provided by Acoustiblok.

Author Contribution

Stan Pierce and Kenneth Blum crafted the first draft of this manuscript which was approved and commented by all the co-authors.

Conflict of Interest

Stan Pierce is an inventor on the patent of the Integrity Genesis instrument and instructs the EPIC technique in several chiropractic doctorate programs. The EPIC procedure and patented technology is in commercial use as EPIC Clinics.

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Clinical Case Report

EPIC Technique Spinal Procedure Improves Ocular Motion and Dizziness by Resolving Cranial Nerve VI Palsy

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Abstract

This case study demonstrates that craniocervical spinal alignment with the EPIC technique spinal procedure appears to have a potential positive impact on ocular function. This paper will report the case of a patient with cranial nerve VI palsy and dizziness, and the clinical improvements following treatment with the soundwave technology of the EPIC technique spinal procedure [1].

Objective: To report the case of a patient with cranial nerve VI (CN VI) palsy and the clinical changes that occurred after receiving treatment using the EPIC (Evolutionary Percussion Instrument Corrections) technique spinal procedure.

Clinical Presentation and Evaluation: A 52-year-old female presented with acute insidious onset of cranial nerve VI palsy with complaints of headache and feelings of increased head pressure. Upon eye movement exam, left eye abduction was absent which additionally caused double vision. A neurovascular physical examination using the EPIC technique protocols revealed evidence of the presence of craniocervical subluxation.

Radiographic Findings: A four-view pre-adjustment digital radiographic series of the craniocervical region was taken and analyzed utilizing the EPIC technique protocols. The patient's epigenetic structural profile (aka. epigenetic profile) was ascertained as well as the multidimensional vertebral malalignments between occiput (C0), atlas (C1), axis (C2), and angle of lower neck deviation (aka. misalignment profile).

The C1 vertebra was laterally displaced to the right in a -θZ direction, and rotationally displaced in a +θY direction. C2 was rotationally displaced in a -θY direction (aka. "spinous left") with a lower neck deviated to the left in a +θZ direction. It is important to note the opposite rotational displacement of C1 and C2 about the Y axis, referred to as counter-rotational malpositions of C1/C2 [1] also referred to as a "variable subluxation" [2].

Numerous epigenetic variations were present, the most important of which was bilateral elongated styloid processes observed down to the level of C1 transverse processes.

A single correction vector was then calculated based on both the epigenetic and misalignment profiles of data. [1].

Intervention and Outcomes: The patient was given a single soundwave impulse treatment (correction) to her craniocervical region according to the EPIC technique protocols of care using the Integrity Genesis adjusting instrument [1]. Immediately following the initial correction, the patient was re-evaluated for the presence of subluxation using the EPIC neurovascular physical exam and radiographic assessments. Findings revealed neurovascular indicators of subluxation were no longer present. A two-view post-adjustment EPIC digital radiographic series was taken to measure the biomechanical/structural changes from the treatment. Post-adjustment analysis revealed 95% reduction of C1 laterality (θZ), 22% reduction of C1 rotation (θY), 47% reduction of C2 rotation (θY), and 8% reduction in lower neck deviation (θZ). The C1 and C2 counter-rotations reduced by a combined 38%.

After the initial EPIC adjustment, the patient's atlas was adjusted three times total in nine office visits over a six-week period. Three days after the first adjustment, limited abduction was restored to the left eye, but by the fifth week of care, left eye abduction was fully restored and the patient no longer experienced double vision. Patient also reported significant reduction in headaches with much less intensity compared to symptomatology she experienced prior to initiating care.

Conclusion: This patient's functional ocular improvement following the EPIC technique spinal alignment procedure appears to indicate a potential correlation with craniocervical alignment and cranial nerve function. There are potential vascular correlations between the craniocervical junction and cranial nerve function, however the exact mechanisms of functional improvement is still unknown.

It is inherently very difficult to draw any conclusions from a single case study, and more research is needed in the area of craniocervical specific chiropractic care and the impact on cranial nerve function and fluid flow dynamics. However, due to the low risks associated with the EPIC technique spinal procedure and the positive patient outcomes demonstrated in this case, the EPIC procedure deserves further investigation for its potential utilization in cases involving cranial nerve dysfunction.

Keywords: EPIC, Spine, Cranial Nerve, Ocular Function, Craniocervical, Eye Health, Chiropractic, Subluxation, Sound Wave Technology and Biomechanical Alignment

History and patient presentation

A 52-year-old female presented to the clinic with acute insidious onset of horizontal binocular diplopia with complaints of headache and feelings of increased head pressure. Patient had a history of a lumbar dural puncture from an epidural that was years prior, which had self-resolved. Three years prior to coming to our clinic, patient was diagnosed with mild idiopathic hypertension being managed through medications. Five months prior to care, the left eye felt more comfortable being turned in (adducted) while watching television. Four months prior to care, the patient received a Shingles/Herpes Zoster vaccine. During that same month the patient described experiencing “ice pick” headaches that began from the temples wrapping around temporal bones bilaterally. Two months prior to care, the patient became overheated at a concert and thereafter experienced bouts of head and neck pain. A month before care, CN IV palsy started with associated dizziness, nausea, a feeling of increased head pressure, and headache. Upon initial onset of this palsy, the patient was admitted to ER for evaluation to include TIA and stroke protocols. All medical test results revealed no findings or correlations to the cause of the CN VI palsy, dizziness, or nausea, including the TIA and stroke protocols being negative. Upon discharge from the ER, the patient was prescribed medications to help reduce the headache, nausea, allergies, and feelings of head pressure.

Patient presented to EPIC Clinics with complaints of double vision associated with CN VI palsy, headaches, and feelings of increased head pressure. Extra ocular muscle function test revealed absence of left eye abduction when attempting to look left.

Neurovascular examination findings

As per the EPIC examination protocol [1], an analysis of her systemic neurologic function revealed upper right extremity strength deprivation, unilateral hypertonic left lumbar erector muscles, and a left leg length discrepancy of 1 inch. Upon left head rotation, neurological indicators normalized (arm weakness, lumbar muscle tightness, leg length discrepancy), indicating that cervical misalignment could be causing the neurologic dysfunctions. Posture analysis revealed left head tilt and left head translation, as well as an elevated left shoulder. Palpation of the suboccipital region revealed edematous inflammation in the region of the right C2 dorsal root ganglion (DRG) that was painful. Fakuda’s Step Test demonstrated a positive finding for cerebellar imbalance with forward translation and 45-degree left turn. The EPIC examination protocol indicators gave evidence to the existence of a craniocervical subluxation.

Digital radiographic examination findings

Biomechanical Considerations

A radiographic study of 4 views was performed to further assess the craniocervical dysfunction. (Figure 1) Findings from the sagittal plane radiograph revealed a loss of the normal lordotic cervical curve, degeneration at multiple disc levels with associated hyperexostosis (spurring).

Additionally, radiographic findings from the frontal plane included multiple measurable biomechanical irregularities. (Figure 1) The biomechanical irregularities include.

Figure 1: Sagittal and Frontal digital radiographs.

- C1 spinal misalignments of -1.28 θZ and +4.42 θY
- C2 spinal misalignment of -7.20 θY
- Lower cervical spine deviation of +2.78 θZ

The +4.42 θY C1 misalignment and -7.20 θY C2 misalignment revealed opposite rotations, forming a cumulative counter-rotational misalignment condition of 11.62 degrees around the Y-axis. This counter-rotational malposition could produce abnormal stress to the vertebral artery vascular supply to the midbrain/cranial nerve center. In a case study involving a patient with bow hunter syndrome that was treated with an upper cervical alignment procedure, after the adjustment they found that vertebral artery flow was increased by 8.2% on the left and 22.2%

on the right as measured by vascular ultrasound [3]. Additionally, this counter-rotational malposition may compromise adequate flow of the CSF fluid between the brain and the spinal canal [4].

Epigenetic considerations

Patient's radiographic findings from the frontal plane also reveal that she has epigenetically elongated styloid processes extending down to the C2 vertebral level. (Figure 2,3) This presents an additional risk factor to compression of the internal jugular vein between the elongated styloid process and the transverse process of a θY rotationally misaligned vertebra. As stated before, counter-rotational misalignments may additionally obstruct CSF flow by narrowing neural canal space. The radiographs also revealed an asymmetrical inferior posterior arch attachment, rendering it unusable for analysis.

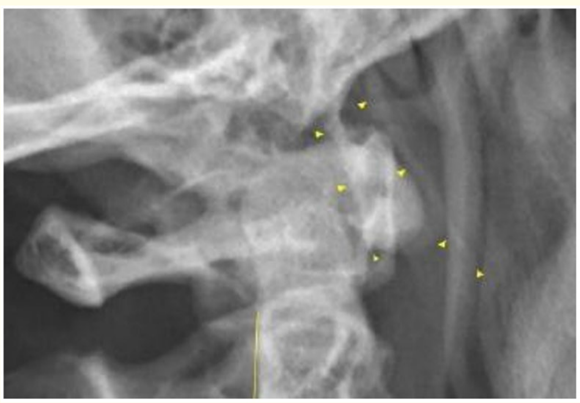

Figure 2: Styloid process elongation seen on the sagittal radiograph.

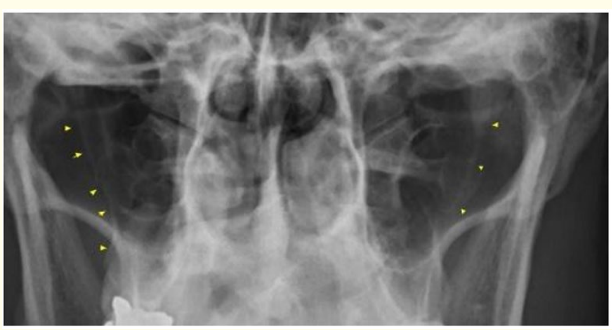

Figure 3: Styloid process elongation seen on the frontal radiograph.

If the counter-rotational malposition of the C1 and C2 vertebrae compresses the internal jugular vein compression and disrupts the CSF fluid flow, that could create abnormal fluid pressure and flow in and around the brain tissue (called cranial hydrodynamics). Considering the rotational θY malposition of C1, it could be possible to compress the anterior root of the transverse process into the posteromedial internal jugular vein unilaterally, further compromising proper hydrodynamics to one side of the brain [5].

An MRI was conducted upon the patient's admission to the ER. The radiology report noted "ventricles and sulci are normal in size" and "no acute intracranial abnormality". Though there may have not been a pathological finding on the MRI scan, below you can see there are notable differences in the size of the sulci of the brain and ventricles (Figure 4).

This may be contributed to abnormal fluid dynamics in and out of the skull [4].

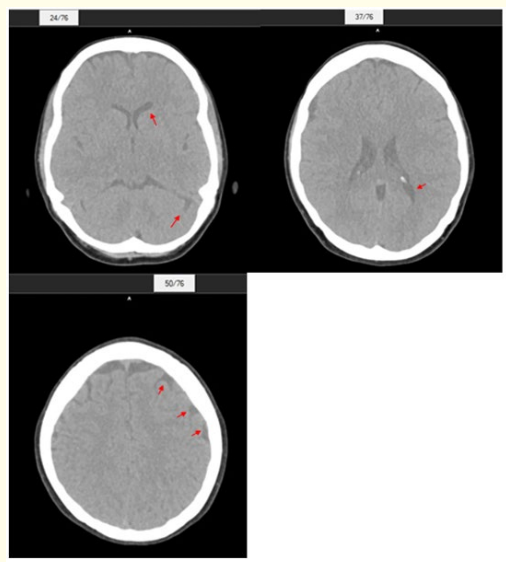

Figure 4: Series of sequential imaging slices showing asymmetrical brain fluid accumulation.

Treatment

The EPIC (Evolutionary Percussive Instrument Corrections) technique spinal procedure was used to detect and correct the craniocervical subluxations. The treatment course of care begins with delivering a specific measurable sound impulse utilizing the patented, FDA-registered 3-axis percussion adjusting instrument called the Integrity Genesis [6]. Following the initial correction, another series of digital radiographs were immediately taken and measured for consideration of biomechanical alterations from the correction.

Spinal alignment correction

The craniocervical subluxation was treated using a sound impulse instrument called the Integrity Genesis [6].

The patient was placed in a side-lying position with customized pre-set joint influences to encourage the multidirectional biomechanical misalignments to respond to the treatment. Coordinates obtained from measuring the epigenetic and misalignment profiles on the EPIC digital radiographic were then calibrated into the adjusting instrument. The instrument stylus was positioned just off the surface of the skin, targeting to the C1 vertebral transverse process (Figure 5).

Figure 5: Instrument targeting C1.

A solenoid-striking adjusting mechanism in the instrument's head was then activated to create an acoustic wave of 61.5dB at 2.5 kHz traveling at a speed of 345.8 m/s that was administered non-invasively to the C1 vertebra [6]. This unique mechanism is used to instantaneously correct the craniocervical misalignment syndrome (aka. Craniocervical subluxation).

Post adjustment neurovascular examination findings

Immediately following the EPIC procedure, the patient was examined for the presence of craniocervical subluxations. The palpatory edematous swelling of the C2 dorsal root ganglion region was resolved and no longer painful to the touch. Her lower back muscle imbalance had normalized, and her supine leg length discrepancy was balanced.

Post adjustment digital radiographic findings

The digital radiographic examination was repeated immediately after the first correction using the same exact standards as the pre radiographic examination. The findings were as such:

- C1 spinal misalignments of -1.28 θZ decreased to -0.06 θZ, and +4.42 θY decreased to +3.43 θY.
- C2 spinal misalignment of -7.20 θY decreased to -3.84 θY.
- Lower neck deviation of +2.78 θZ decreased to +2.56 θZ.

This equated to a 96% reduction of C1 lateral displacement, a 22% reduction of C1 rotational malposition, and a 47% reduction of C2 rotational malposition. This equated to a resultant 38% cumulative reduction of the C1/C2 counter-rotational misalignment condition (Figure 6).

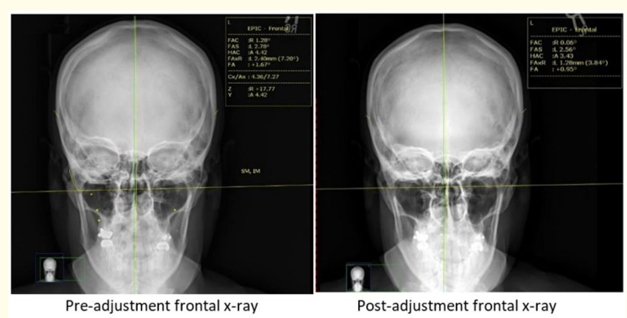

Figure 6: Comparison of pre and post adjustment radiographic findings.

Outcomes

The patient's treatment was chronicled in the table below (Figure 7). After 3 days of holding the first correction, "holding" meaning all neurovascular indicators were negative for the presence of subluxation, a bilateral eye movement test revealed there was a slight improvement in left eye abduction. The small increase in function did not yet improve the double vision at this point, however the patient reported that the headaches were much better than before the adjustment.

Time since fist adjustment	Visit number	Primary complaint	Intervention
0	1	Left eye loss of abduction, diplopia, pain referring from neck into head and behind eyes	UC-Adjustment
1 Day	2	Loss of abduction, diplopia	UC-Exam/Holding
2 Days	3	Loss of abduction, diplopia	UC-Adjustment
5 Days	4	Loss of abduction, diplopia	UC-Exam/Holding
1 Week	5	Mid back pain	UC-Exam/Holding
5 Weeks	6	Head and neck pain	UC-Adjustment
5 Weeks 1 Day	7	Right neck stiffness	UC-Exam/Holding
5 Weeks 2 Days	8	None	UC-Exam/Holding
5 Weeks 3 Days	9	Ear pressure	UC-Adjustment
5 Weeks 4 Days	10	Mild neck discomfort	UC-Exam/Holding

Figure 7: Timeline demonstrating visits requiring craniocervical (UC) adjustment or if none needed.

Patient held her initial correction for 2 days. The patient's second correction held for at least 5 days after which time the patient returned to her out-of-state home for 4 weeks. When the patient returned for care in week 5, neurovascular indicators revealed the craniocervical subluxation has recently recurred, yet the left eye abduction was fully functional, and the symptoms related to diplopia were resolved (Figure 8). During this visit, the patient's craniocervical junction was adjusted. The patient held this correction for 2 days following which the patient complained of ear pressure and presented with neurovascular indicators of craniocervical subluxation and was adjusted. She maintained that correction until her final appointment the following day when she returned home out-of-state.

Figure 8: Left ocular abduction change following EPIC treatment.

The patient received a total of 4 craniocervical adjustments over a 5 week and 3 day period of time. During that time, her ocular function completely normalized, headaches improved, and diplopia resolved.

Potential etiology

Reduced arterial flow.

There is a potential correlation of upper neck alignment affecting ocular functions. Lateral eye movement is performed by the lateral rectus muscle which is controlled by the abducens nerve (CN VI) (Figure 9).

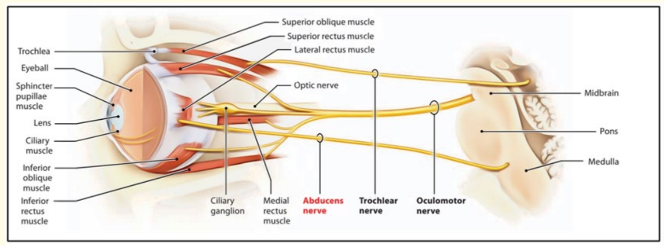

Figure 9: Lateral rectus muscle innervated by the abducens nerve.

The abducens nuclei is primarily blood supplied by the vertebral artery vascular distribution pathway. (Figure 10) The vertebral artery passes through the transverse foramen of the cervical vertebra and takes 4 90-degree turns when passing through the craniocervical junction of the upper spine. It is feasible that malalignment (subluxation) of the craniocervical junction could alter the vertebral artery provision to the abducens nuclei as well as other cranial nerve nuclei.

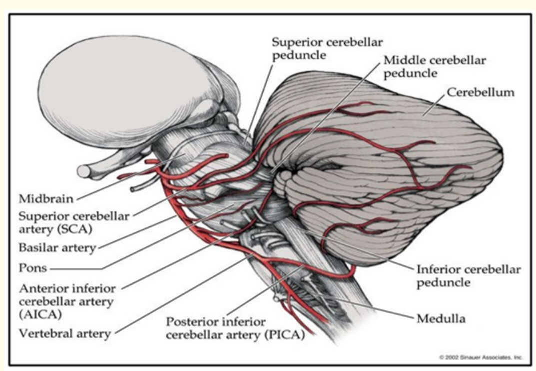

Figure 10: Vertebral artery distribution pathway to cranial nerve center.

The presence of torsion of the vertebral artery due to the counter-rotationally misaligned upper cervical spine is evident in this patient's scans. (Figure 11, Figure 12) This would imply the potential for altering and potentially diminishing the vascular flows through the vertebral arteries to the abducens nuclei.

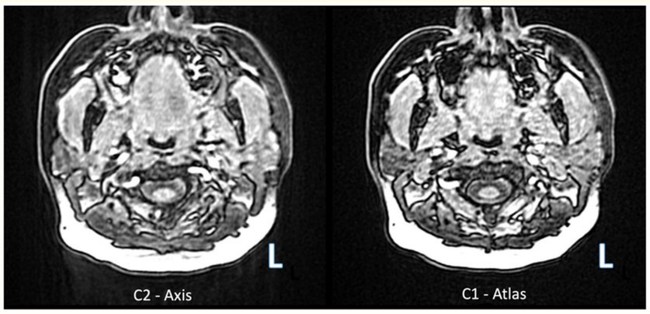

Figure 11: Visible torsion of the vertebral artery ascending through C2 and C1.

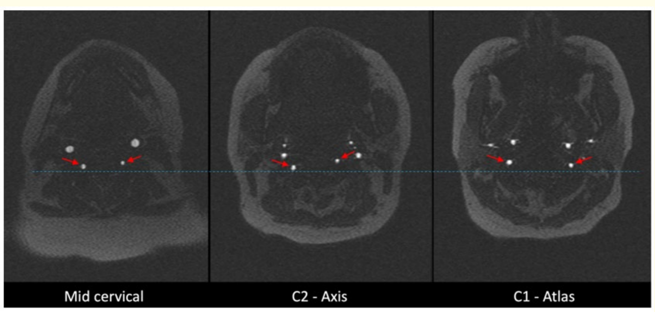

Figure 12: Altered position of vertebral artery at various cervical vertebral segments.

The presence of the counter-rotationally subluxation Occiput-C1-C2 relationship appears to be creating a torsion of the vertebral artery, which can diminish blood flow to the abducens nuclei. The hypoxic environment of reduced blood flow to the nuclei could diminish the abducen's neurocapacity for transmitting proper signals to the lateral rectus muscle that it controls, thus reducing abduction ability.

Reduced venous drainage

As the Internal Jugular Vein (IJV) is the primary drainage vessel for the cranium, it is important to recognize that its descending pathway as it leaves the skull is just anterior to the atlas (C1) vertebrae. Additionally, this patient had styloid process elongation down to the level of C2, which forms a non-compressible structure in front of the IJV at the C1 level (Figure 13).

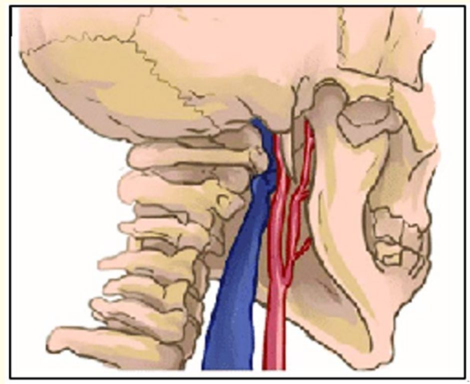

Figure 13: Potential IJV compression.

In that this patient's craniocervical alignment included a C1 rotational component of +4.42 θY, this could have caused the transverse process of the atlas vertebra to press toward or into the IJV. The epigenetic styloid process elongation would have created a "bony wall" in front of the IJV exacerbating any potential compression of the IJV by the rotationally subluxated atlas.

If IJV compression was occurring unilaterally, it could theoretically cause a unilateral (one-sided) "backlog" of fluid in the brain hemispheres. In that (Figure 4) shows the patient's brain scans demonstrated unilateral accumulation of fluid in the brain on the same side as the reduced left lateral abduction, this could present evidence to the IJV compression possibility. It is feasible that another potential etiology of the unilateral fluid accumulation from the craniocervical subluxation could have created some type of edematous compression on the abducens nerve, thereby reducing the function of that nerve and associated ocular muscle performance.

Limitations

It is inherently very difficult to draw any global conclusions from a single case study and more research is certainly needed in the area of craniocervical alignment procedures and their potential impact on cranial nerve function and cranial hydrodynamics. As this case was evaluated and managed for only approximately 6 weeks, studies over a longer period of time may provide stronger evidence of sustained resolution of dysfunction and symptomatology.

Conclusion

This case appears to demonstrate that improving the craniocervical junction alignment using the EPIC technique spinal procedure may have a possible positive impact on ocular function. This case also appears to correlate that a craniocervical subluxation may have a potential negative impact on cranial hydrodynamics and/or cranial nerve function.

Due to the low risks associated with the Evolutionary Percussive Instrument Corrections (EPIC) technique [6] and the potential positive patient outcomes demonstrated in this case, the EPIC procedure deserves further investigation for its potential utilization in cases involving cranial nerve dysfunction.

Due to the small sample size of this paper, additional confirmation with a much larger sample size and possibly controls is needed to come to any definitive conclusions.

Acknowledgements

Kelcey Wiginton, DC co-managed this case with the author of the article. Russell Goff, DC assisted in the original data collection of this case writeup and initiated portions of the first draft of this submission.

Conflict of Interest

Stan Pierce is an inventor on the patent of the Integrity Genesis instrument and instructs the EPIC technique in several chiropractic doctorate programs. The EPIC procedure and patented adjusting technology are in commercial use as EPIC Clinics®.

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Scientific Rationale, Clinical Protocols, and Positive Patient Outcomes of the EPIC Technique Spinal Procedure

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Abstract

Inside the chiropractic profession, there are many diverse procedures and approaches to spinal care. Although each individual Doctor of Chiropractic (DC) may practice chiropractic with their own individual systems and techniques of care, those procedures are rooted in established techniques taught in the curriculum of various chiropractic colleges and universities. One of those established techniques is called EPIC. "EPIC" is an acronym for Evolutionary Percussive Instrument Corrections. It is a chiropractic technique that focuses on the use of progressively advancing diagnostic and adjusting technology to correct the craniocervical junction alignment. Its mission statement is: "We believe in challenging the status quo in healthcare, as well as in chiropractic. Forever striving to improve our quality of care, we will always look for the next conceptual or technological breakthrough that will help us achieve better spinal corrections for optimal patient health."

History

The EPIC technique is a direct genealogical descendant of the technique originally developed by the founding family of chiropractic. In 1895, Daniel David "DD" Palmer, DC first discovered and termed the spinal "subluxation", defined as a condition of the spine where a vertebra has lost its correct juxtaposition to the extent of disrupting the nervous system function. His son, Bartlett Joshua "BJ" Palmer, DC spent a lifetime of chiropractic research and concluded the premise of ADIO (Above-Down-Inside-Out) in referencing the flow of the nervous system primarily going from the brain, down the spinal cord, out the nerves to the effected/controlled areas. Based upon this concept, Dr. BJ Palmer focused on refining a procedure to analyze and adjust the 2 upper cervical vertebral misalignments calling that area "the true subluxation" and, in the early 1900s, developed a technique called Hole-In-One (HIO)/Toggle focusing on adjusting this unique area. The existence of the subluxation's neurologic imbalance was determined through neurophysical examination. The direction of atlas (C1) malposition was then obtained from radiographic evaluation and was defined through positional listings (i.e. ASLP, AIRP, etc.) to give a general understanding of what direction the chiropractor needed to adjust it. The axis (C2) malposition was given a separate general designation from the radiographs and required a separate adjustment. Following the adjustment, the neurophysical criteria were re-examined to assess change, but post adjustment radiographs were not standardized to be taken. His approach was the foundation of the science, results, and public perspective of the beginning of the chiropractic profession and was called the Toggle technique.

In the 1930s, John Grostic, DC, refined the radiographs and measured angles used to assess the cervical malposition, quantified these malpositioned vertebrae on a mathematical engineering platform. He refined the adjusting art to reduce the amount and depth of thrust, and to improve the accuracy of the adjusting line of drive. He utilized a post x-ray analytical comparison after the first adjustment to objectively verify alignment had been improved. This technique was known as the Grostic technique.

In the 1970s, Roy Sweat, DC, developed a 2-axis, table-mounted, adjusting instrument that could deliver a percussive soundwave to align the upper cervical spine. He refined the line of drive measurement into a degree-specific calibrated adjustment, still using post adjustment examination and x-ray verification. Although the C1 vertebra was measurably misaligning around the Z and Y axis of the right-handed Cartesian coordinate system, Dr. Sweat's instrument was designed to pivot around the patient's Z and X axis with a resultant Y directional effect. This technique has been known as the Atlas Orthogonal technique.

In 2001, Stan Pierce Sr., DC, and Stan Pierce Jr., DC, added further refinements to the radiographic analysis protocol to include data transposition between radiographs for anatomical clarity, methods to validate reference line determination and measurement accuracy, and evaluation methods to determine genetic abnormalities that would affect the understanding of each patient's "normal" position into which they needed to be adjusted. Their chiropractic technique was the first to upgrade to digital x-ray with computerized analysis. Additionally, they created a more refined patient positioning protocol to control biomechanical reductions of the adjustment, improved accuracy of the instrument's line of drive vector calibration and developed a comprehensive post x-ray interpretation to improve case management. This technique was known as the Advanced Orthogonal technique.

In 2014, Stan Pierce Jr., DC, launched a more aggressive evolution of developments in this lineage of concepts and technology. Guiding the same board of directors of his previous technique, Dr. Pierce Jr. lead a team to streamline imaging analysis, remove analysis error through advanced software coding, identify additional genetic considerations, and refine anatomical considerations. They then enhanced biomechanical influences in patient positioning through eliminating error in skull positioning, and other errors in the vector calibration. His team created the first 3-axis percussive adjusting instrument thus becoming the only technique in chiropractic that can purely calibrate the percussive adjusting force to match the axis of vertebral malposition. They developed a digital calibrating system and laser targeting system for the adjustment. His team developed a software program to assist the doctor in clinical implementation of performing the biomechanical influences and vector-calibrating accuracy, and to obtain and compare clinical data on an international platform for standardizing quality of care, also producing a vast amount of data points for clinical studies. This technique is known as Evolutionary Percussive Instrument Corrections (EPIC) and is taught by Dr. Pierce Jr. and his team in numerous chiropractic institutions of higher education.

Neurological Effect

The balance of the body's nervous system is dramatically affected by the relationship of the craniocervical junction. Much of the balance of the body is determined through neurologic control called **mechanoreceptor feedback loops**. Mechanoreceptor feedback is given in large part by the spindles of the muscles, and the muscle with the highest density of spindles per gram of tissue is the obliquus capitis inferioris muscle (242 spindles/gram of tissue) that inserts at the transverse process of the C1 vertebra and the spinous process of the C2 vertebra. The second most dense muscle is the obliquus capitis superioris with 190 spindles/gram of tissue. For comparison, the lumbar erector muscles have 40 spindles/gram of tissue (Figure 1).

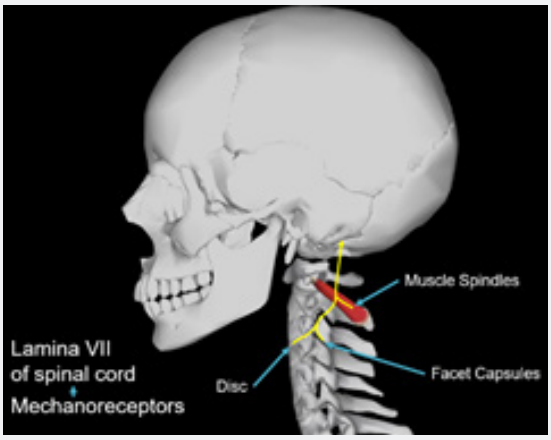

Figure 1

When the left and right obliquus capitis inferioris muscles go out of tonal balance due to craniocervical subluxation, this can disrupt the bilateral balance of spindle mechanoreceptor neurofeedback to the cerebellum. The cerebellum then transmits the imbalance to the vestibular nucleus, and in response, the vestibular nucleus may stimulate a neurologic alteration of the postural spinal muscle balance. Additionally, disrupted mechanoreceptor feedback to the cerebellum may transmit through to the limbic, sensory, and cerebral cortices. It is plausible that a malposition of the craniocervical junction could affect emotional stability, dermatomal distributions, hypersensitivities, cognitive functions, memory and more through this neurodysfunction. In that the cortex directly communicates with the hypothalamus, and the hypothalamus controls the pituitary glands endocrine regulation, it is plausible that the neurodysfunction of the craniocervical junction could affect the regulation of hormones. Additionally, the hypothalamus communicates through the pons, to the sympathetic chain, to the intermediate lateral tracts of the spinal cord which can then affect immune function, blood vessel dilation, annulus of the vertebral discs, viscera of the organs, etc.

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Thus, it could be theorized that a craniocervical subluxation may contribute to an extremely wide variety of clinical conditions and associated symptomatology, as well as alter the overall health of the patient (Figure 2).

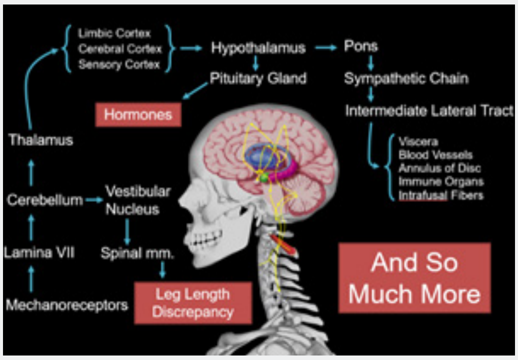

Figure 2

Vascular Effect - Arterial

Like all muscles, the myotonicity of the arterial walls is neurologically controlled. It is possible that an alteration in the above referenced mechanoreceptor feedback loop through the intermediate lateral (IML) tract to the myotonicity of the blood vessels could alter the diameter size of the vessel and the associated rate of blood flow. Altered diameter and flow rate may result in altered blood pressure. This is a plausible explanation for the documented patient outcomes of significantly reduced high blood pressure from a craniocervical chiropractic alignment procedure referenced in the study below.

Study: Atlas vertebra realignment and achievement of arterial pressure goal in hypertensive patients: a pilot study Journal of Human Hypertension. 2007 *G. Bakris, M. Dickholtz Sr, et al.* [1] "Anatomical abnormalities of the cervical spine at the level of the Atlas vertebra are associated with relative ischemia of the brainstem circulation and increased blood pressure (BP). This study indicated that restoration of Atlas alignment is associated with marked and sustained reductions in BP like the use of two-drug combination therapy."

Another potential arterial effect of a craniocervical subluxation is a directional alteration in the structural pathway of the vertebral artery. Termed the "vertebral" artery due to its ascension through the transverse foramen of the cervical vertebrae, the vertebral artery takes four right angle turns as it passes through the craniocervical junction. It is plausible that a rotationally misaligned C1 (atlas) vertebra may cause an abnormal torsion of the vertebral artery and resultingly affect flow rate (Figure 3). Additionally, a craniocervical subluxation that includes a rotationally displaced C1 (atlas) vertebra and a counter-rotationally displaced C2 (axis) vertebra can potentially cause additional torsion to the vertebral artery. In that the vertebral artery is the primary blood supply to the midbrain and cranial nerve centers, it is plausible that a craniocervical subluxation could alter the vascular supply to the brain.

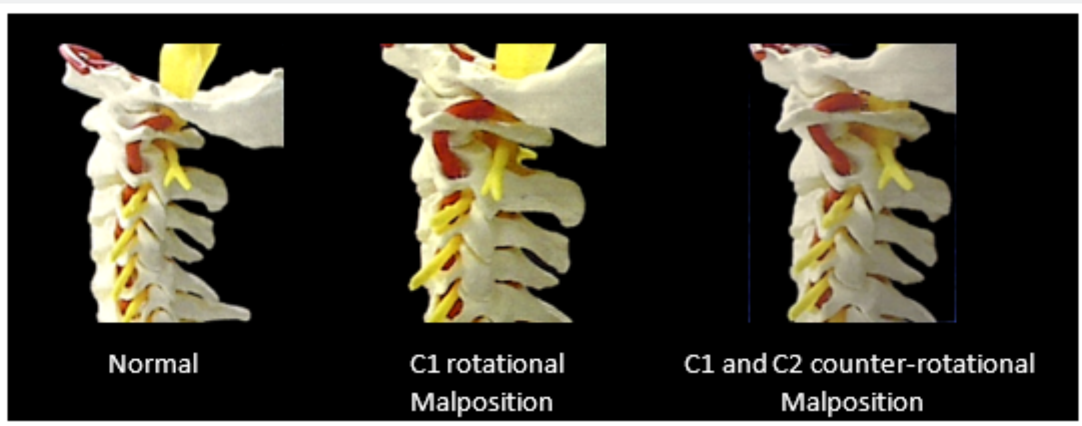

Figure 3

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Vascular Effect – Venous

The internal jugular vein (IJV) is the primary vascular drainage of the brain. It is relevant to recognize that the IJV descends just anterior to the C1 transverse process, and that compression of the IJV from the C1 vertebra can affect cerebral drainage capabilities of this vein and associated cranial hemodynamics.

Study: Incidence of Extrinsic Compression of the Internal Jugular Vein in Unselected Patients Undergoing CT Angiography American Journal of Neuroradiology. August 2012 *M.V. Jaraman, J.L. Boxerman, et al.* [2]. The study published in this edition of the American Journal of Neuroradiology noted that the internal jugular vein can become compressed by the atlas transverse process.

Study: Compression of the Internal Jugular Vein by the Transverse Process of the Atlas as the Cause of Cerebellar Hemorrhage After Supratentorial Craniotomy Eduardo Seoane, MD, Albert L Rhoton Jr., MD Surgical Neurology [3]. The study in this edition of Surgical Neurology concluded that the "obstruction of flow in the internal jugular vein at the site where the vein descends across the transverse process of the atlas is a likely cause of the venous hypertension that has resulted in the cerebellar hemorrhage reported in numerous cases after supratentorial craniotomy."

Study: Incidence and Distribution of Extravascular Compression of Extracranial Venous Pathway in Patients with Chronic Cerebrospinal Venous Insufficiency and Multiple Sclerosis Phlebology. 2014, Vol. 29(7) 476-479 Radak Djordje, Ilijevski Nenad, Kolar Jovo, Sagic Dragan, et al. [4]

"Our data indicate that extravascular compression of the extracranial venous pathway is frequent in multiple sclerosis patients with chronic cerebrospinal venous insufficiency, and that it is mainly due to compression caused by transverse processus of cervical vertebrae. Further studies are needed to evaluate potential clinical implications of this phenomenon." It is quite plausible and rational that an undetected and uncorrected craniocervical subluxation could negatively affect the vascular drainage of the brain, resulting in increased intracranial hypertension. This pressure increase could be a contributing factor in migraine headaches, dizziness, idiopathic seizures, TIAs, and other conditions. It seems plausible and rational that unresolving increased intracranial hypertension could complicate a patient's recovery from TBI and/or concussions, as well as CTE, and could be an initiator or exacerbator of PTSD, depression, and/or other psychological conditions.

Cerebrospinal Fluid (Csf) Flow

Increased intracranial hypertension can have a disruptive effect on the cranial glymphatic system which can negatively alter the flow of the cerebrospinal fluid (CSF).

Study: The Glymphatic-Lymphatic Continuum: Opportunities for Osteopathic Manipulative Medicine Jama. 2016 *Kyle Hitscherich, OMS II; Kyle Smith, OMS II; Joshua A. Cuoco, MS, OMS II; et al.* [5]. This study discusses the connection between the blood-brain barrier, the CSF, the glymphatic system, and the potential for manipulative medicine to be used in the treatment of associated neurologic disorders.

Craniocervical subluxations that include rotational displacement of the C1 vertebra, C2 vertebra, both C1 and C2, and especially with counter-rotational displacement of the C1 and C2 vertebrae, can alter the space within the neural canal. It is plausible that diminished spinal canal diameter can cause a disruption of CSF flow, as has been noted in diagnostic imaging. It is plausible that reduced CSF flow due to craniocervical subluxation may negatively impact the potential for recovery from TBI, CTE, and concussions, as well as a potential contributor to the development of many brain-deterioration diseases.

Elongated Styloid Process Impact

Descending inferiorly from the skull are the styloid processes, the insertion points for the stylohyoid ligament. The styloid processes are non-compressible, boney structures just anterior to the IJV. Data analysis of over 3,000 patients from various EPIC clinics around the country revealed that, on average, 60% of patients over the age of 20 have styloid processes that are elongated down to the level of the C1 (atlas) transverse process. This creates an osseous structure both anterior and posterior to the IJV bilaterally, with the C1 transverse process posterior to the IJV. It is plausible that a rotationally misaligned C1 vertebra could result in vascular compression of the IJV into the elongated styloid, resulting in increased intracranial hypertension.

Results

Study: Incidence of Extrinsic Compression of the Internal Jugular Vein in Unselected Patients Undergoing CT Angiography M.V. Jayaraman, J.L. Boxerman, L.M. Davis, et al. American Journal of Neuroradiology [2].

Moderate stenosis was seen in 33.3% of right and 25.9% of left internal jugular veins. Severe stenosis was seen in 24.1% of right and 18.5% of left internal jugular veins." "The third parameter was the cause of the extrinsic compressions (styloid process, posterior belly of the digastric muscle, C1 transverse process). Examples are given in Figure 1. In all cases, the compression was caused by two factors. The posteromedial aspect of the compression was caused by the adjacent cervical vertebra, which provides a non-compressible structure against which the vein is pressed." We found that extrinsic compression of the internal jugular vein is common in unselected patients. The most common causes of this are the styloid process or posterior belly of the digastric muscle, often adjacent to the lateral mass of C1."

Full Spine Effect

A craniocervical subluxation can rapidly or gradually affect the entire spinal balance. Displaced upper cervical vertebrae,

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by altering the bilateral tonicity of the highly dense muscle spindles of the obliquus capitis inferioris muscles, can alter the mechanoreceptor feedback loops through the cerebellum to the vestibular nucleus. In response, the vestibular nucleus can induce a unilateral hyper-stimulation of the spinal posture muscles in different regions of the spine, or a hypo-stimulation of the opposite side. This imbalance of postural muscle tone can begin to bend the spine toward one side and/or create a functional "short leg" phenomenon as the pelvis becomes tilted. As the patient's vertical posture is now being altered, secondary full spine effects can occur, such as:

- Twisted rib cage
- Scoliosis
- Disc bulges/herniations
- Rotated sacrum
- Secondary vertebral malposition/fixation/subluxation (Figure 4)

Study: Experimental kyphoscoliosis induced in rats by selective brain stem damage

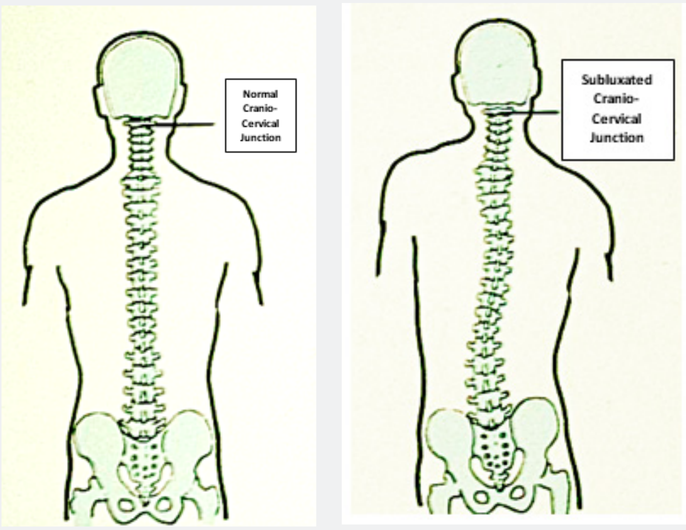

Figure 4

PMID: 1428313 C Barrios, J I Arrotegui. "The relationship between damage to particular brain stem nuclei related to postural control and equilibrium and the occurrence of spinal deformity has been investigated. The model used was the Wistar albino rat and the brain stem structures damaged were the gracillis nucleus, the superior colliculus and the lateral vestibular nucleus. Out of 60 brain stem damaged animals, 44 had accurate lesions from which 11 (25%) showed kyphoscoliotic deformities. Rats with spinal deformity showed an imbalance of the paraspinal muscles when assessed by EMG; this was expressed by an increase of muscular activity on the convex side. This study indicates that postural dysfunction caused by brain stem damage may induce kyphoscoliosis in experimental animals and could be one of the underlying mechanisms in the production of human idiopathic scoliosis."

Study: The Vestibular-Evoked Postural Response of Adolescents with Idiopathic Scoliosis is Altered PMID: 26580068 *Jean-Philippe Pialasse, Martin Descarreaux, Pierre Mercier, et al.* [6]. "Altered sensory reweighting of vestibular and proprioceptive information changed balance control of AIS patients during and after vestibular stimulation. Therefore, scoliosis onset could be related to abnormal sensory reweighting, leading to altered sensorimotor processes.

Lower Extremity Effect

Craniocervical subluxation can result in a twisting of the body through altered neurostimulation of postural muscle tone, resulting in an altered center of gravity. This creates an imbalance of weight distribution on the lower extremities thereby increasing the demand on muscles, ligaments, and fascia. This can lead to unilateral soft tissue injury that occurs during a bilateral activity. Examples of this are unilateral plantar fasciitis, unilateral tendonitis, unilateral muscle strains and tears, a chronic ankle sprain, unilateral Achilles tendon injury, and unilateral Osgood-Schlatter disease (Figure 5). The longer a weight imbalance remains on the weight-bearing joints, the joints can deteriorate at a much faster rate. Examples of this include unilateral hip joint deterioration, unilateral knee joint deterioration, and unilateral ankle and foot pathologies.

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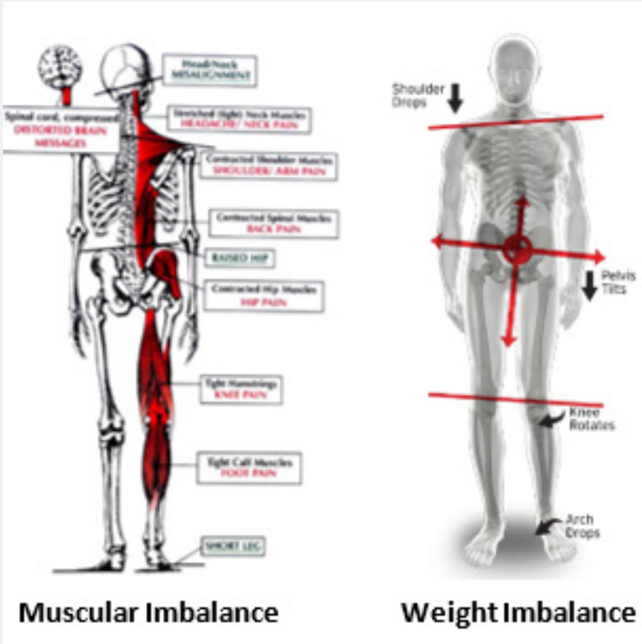

Figure 5

Craniocervical Structural Vulnerability

The upper cervical spine is unlike any other vertebral segment of the body. Although vertebrae of the spine are stabilized by intervertebral discs and posterior interlocking facet joints, the transitionary occiput-C1-C2 region does not have these anatomical features. As a result, over 60% of cervical rotation occurs between C1 and C2, and the first 30 degrees of cervical flexion and extension occurs between occiput and C1. This area of the spine has the greatest range of motion, with minimal capacity for osseous fixation as the occiput-C1-C2 joints are a diarthrodial, synovial, freely moveable joint complex (Figure 6). Without the structural stabilizing components, the upper cervical spine is more vulnerable to injuries and malposition. It has been stated that there is no such thing as a head injury that does not also include a neck injury. When considering that the average weight of the adult head is 10-14 lbs., there is substantially increased potential for the craniocervical junction to become subluxated during head or neck trauma, compared to any other, more stabilized joint of the spine. It is quite plausible that most head injuries would also include craniocervical joint injury. Varying directions and degrees of malposition are possible, causing associated dysfunctions and symptomatology.

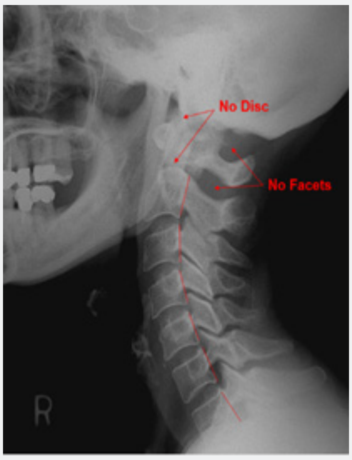

Figure 6

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EPIC Examination

The sequential neurophysical EPIC technique examination is as follows:

i. Supine leg length assessments are taken of each patient using a specific protocol to determine any global spinal imbalance that may be occurring due to the mechanoreceptor alteration of a craniocervical subluxation. This leg length assessment is taken with the patient laying supine with their head supported by a wedged pillow, to maintain spinal postural curves more consistent with upright posture.

ii. While still in the supine position, the patient's lumbar myotonicity is manually evaluated for bilateral balance or lack thereof. In this position the postural muscles should be deactivated, and any unilateral hypertonicity may be indicative of abnormal neurostimulation to the musculature.

iii. With the patient still in the supine position, an isolated shoulder strength test is performed using a modified deltoid break test, bilaterally for comparison. Strength imbalance is noted.

iv. Remaining in the supine position, a craniocervical syndrome test is performed as examination steps 1-3 are performed again to observe any functional changes.

v. With patient now seated, ganglion compartment syndrome assessment is performed to assess for potential edematous accumulation from a craniocervical subluxation.

vi. Overall patient posture is observed.

vii. Fakuda's step test is then used to ascertain any functional loss of center of gravity or cerebellar functional irregularities.

A combination of these findings is used to confirm the presence or absence of neurological indicators of a craniocervical subluxation. Additional tests may also be used, when indicated, to confirm the extent of dysfunction and pathological progression. If the indicators are present, EPIC protocol requires imaging.

EPIC Radiographs

The EPIC technique protocol currently utilizes digital radiographic imaging. The EPIC digital x-ray protocol obtains a minimum of three images of a patient. The name of these three radiographs is congruent with the planes of reference they are attempting to capture: Sagittal, Frontal, and Horizontal x-rays. A fourth x-ray view may be taken to accurately visualize the surface of the C2 vertebra on its own plane of reference. That film is termed the Axial x-ray (Figure 7).

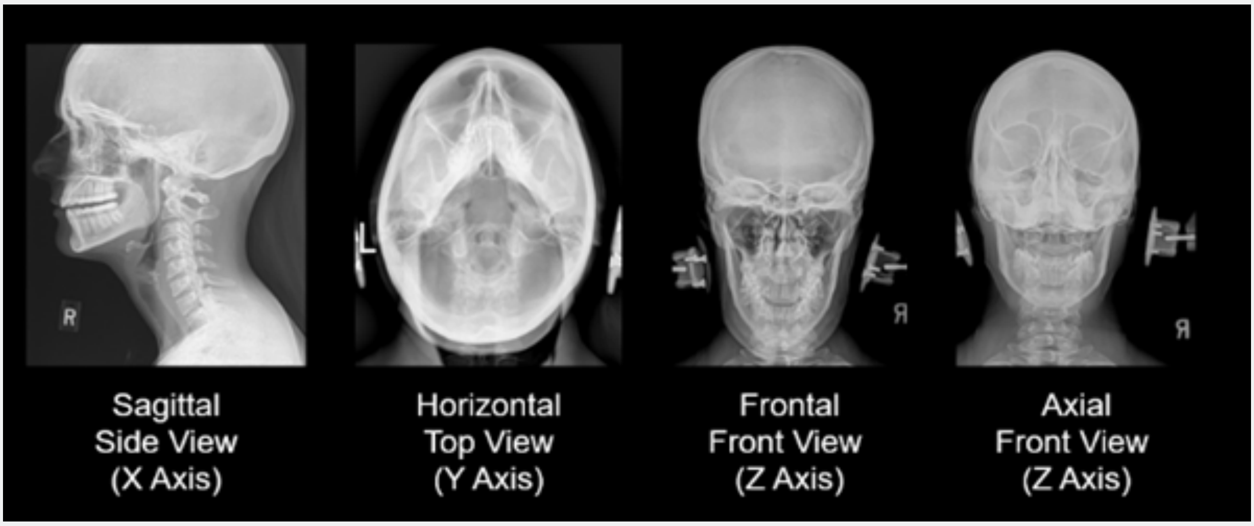

Figure 7

EPIC Radiographic Analysis

The EPIC radiographic analysis uses computer software programs consisting of physics and engineering mathematic formulas applied through contrast differentiation, multi-planar line assessment, dimensional transposition, and CAD overlays designed to assist the doctor with obtaining accurate calculations. Genetic malformations and structural misalignments are measured for each patient. This is imperative, as it was noted by research in 2009 that traditional x-ray analysis for structural malposition can be complicated by genetic asymmetry.

Study: Asymmetry in atlas bone specimens: a pilot study using radiographic analysis JCM 2009: 8, 72-76 John Hart, Matt

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Christopher, Ralph Boone [7]. "These 10 specimens showed an average difference of 0.95 mm +/- 1 SD (0.67 mm) or 2 SDs (1.34 mm) between the left and right sides of the atlas vertebrae. Differences found on radiographs may be due to asymmetry and not actual misalignment."

The EPIC radiographic analysis currently evaluates for 23 genetic asymmetries and/or anomalies to determine what a patient's "normal" structural position should be. The EPIC analysis additionally measures four multi-directional misalignments through computerized analysis to determine the biomechanics of vertebral misalignment, the degree-specific line of drive for the adjusting trajectory, and the targeting location for the impulse.

The four multi-directional misalignments measured are:

- C1 (atlas) to occiput rotational malposition around the Z axis (ØZ)

- C1 (atlas) to cervical spine rotational malposition around the Z axis (ØZ)

- C1 (atlas) rotational malposition around the Y axis (ØY)

- C2 (axis) rotational malposition around the Y axis (ØY)

Due to the fact that the analysis coordinate measurements are within 1/100th of a degree, the accuracy of analysis directly equates to a decreased potential for error in the adjusting angle. With increased accuracy in the adjusting angle and targeting of the impulse, the amount of force used to accomplish the adjustment can be minimized. This accuracy also equates to only requiring a single impulse for the correction (Figure 8). The radiographic analysis also determines the biomechanical influences necessary for positioning the patient prior to the adjustment in order to minimize joint resistance and influence the four misalignments to reduce proportionately and equally with a single, correctional impulse.

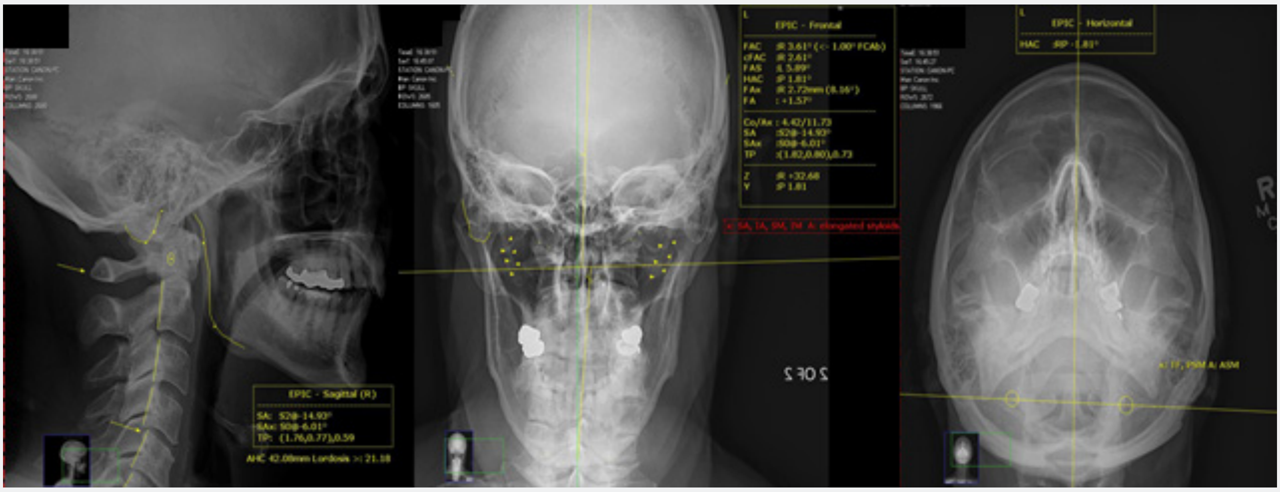

Figure 8

The Adjusting Difference

Most chiropractic adjustments or spinal manipulations have a relatively general application that is administered along the angle of the facet joints to release the fixation of the segment. In that the subluxated C1 and C2 vertebrae do not experience an osseous fixation, as they do not have interlocking posterior facet joints, an alignment procedure for the craniocervical junction does not require a focus on restoring normal motion, but rather correct alignment. The C1 vertebra can misalign around the convexly curved occipital condyles of the bottom of the skull and can misalign around the convexly curved C2 superior surface. Systems of analysis typically include a consideration of the convexity of the surfaces for customizing an accurate angle for each individual patient's correction. Also, there are four multi-directional, multi-numerical misalignments of the craniocervical junction as well as numerous genetic asymmetries in the anatomical development of the bones that must be measured and accounted for in customizing the adjusting procedure (Figure 9). Researchers White and Panjabi noted that the C1 vertebra can misalign with a maximum lateral displacement of only 5 degrees, which is 1/8 inch [8]. Combining this fact along with the lack of joint fixation concludes that aligning the craniocervical junction may only require minimal force and minimal depth. Also, contrary to most adjustments and/or manipulations that might take a vertebral segment to its full end range of motion, and then thrust beyond to perform the treatment, adjustments of the craniocervical junction can be done in normal range of motion, protecting the integrity of the surrounding soft tissue.

The Adjusting Technology

The EPIC procedure aligns the craniocervical junction using a percussive sound wave impulse, rendered on a precisely calibrated line of drive (angle) that is accurately targeted to the C1 (atlas) transverse process.

This is done using the ***Integrity Genesis*** adjusting instrument. This device is the first 3-axis percussion adjusting instrument in

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the history of chiropractic. It is a table-mounted instrument that is FDA registered, patent-pending, manufactured under ISO 9001-2015 manufacturing standards, and is exclusive to EPIC. The design of the ***Integrity Genesis*** allows for coordinate calibration in the axis of adjusting to be consistent with the axis of misalignment, and the coordinate settings for the instrument are calibrated to the exact leverage angle measured on the x-rays based upon the misalignments and genetic asymmetries/anomalies (Figure 10). Digital calibration, laser targeting, motorized shoulder piece, dual patient safety mechanisms, airplane-grade materials, medical-grade high-capacity linear rails and reciprocating bearings, solid state Teflon, IPX6 protection class electronics, patented construction systems and more are innovative features of the ***Integrity Genesis***.

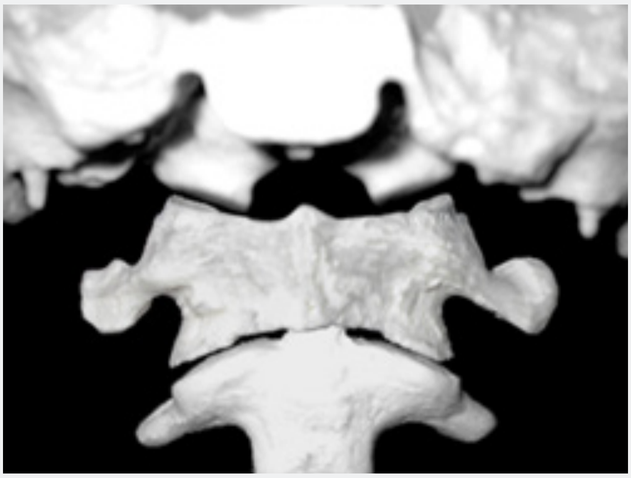

Figure 9

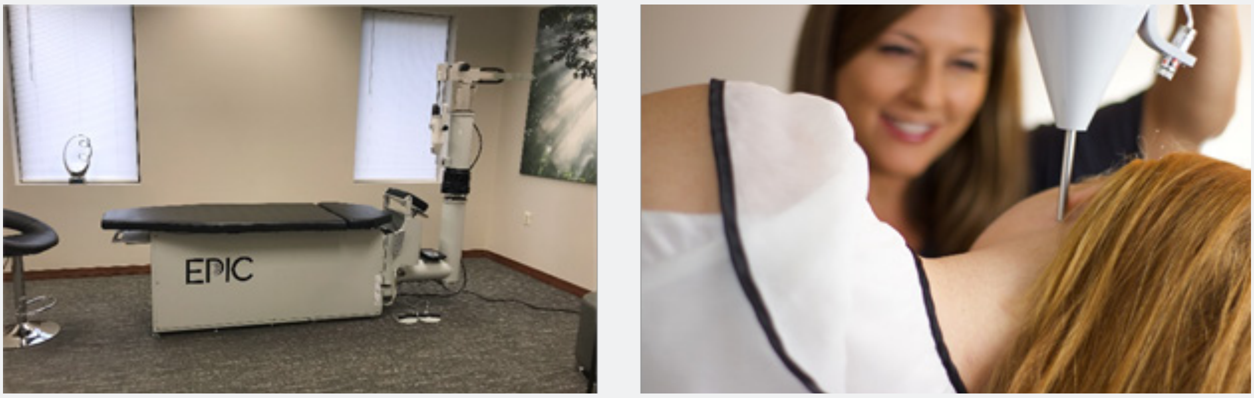

Figure 10

The Adjusting Force

The use of sound wave therapy has become more common in healthcare. Lithotripsy for breaking up kidney stones, ultrasound used to treat muscle and joint injury, radiofrequency ablation of nerves, and even the sound wave treatment of cancer, are just a few examples of current uses of sound treatments. The use of a percussive impulse adjusting to alter the C1 vertebral alignment has been utilized in the chiropractic profession since the 1970s. The EPIC procedure uses a percussive impulse generated by an electromagnetic striking device, to deliver a gentle, non-invasive, degree-specific force at a specified spinal location. The device is placed just off the skin, calibrated on a multi-axis coordinate setting, and aligned to the patient's C1 transverse process. All patient positioning for the adjustment, as well as all instrument calibrating systems, are customized for each patient based upon the radiographic measurements obtained through the computerized analysis. Using mathematics, physics, and technology, the EPIC doctor is able to rely less on opinion and experience, and more on measurements and science to render precision care for a patient.

Additionally, the use of a percussive impulse can overcome anatomical variables that can complicate typical adjustments or spinal manipulations. Basilar invagination, overgrown mastoids, elongated styloid processes, ear cartilage, large mandibles, etc. can interfere with being able to send a manual, excursion, or

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“pushing” type of adjusting force into the contact point of the C1 transverse process, which is located typically ¾ - 1 inch below the surface of the skin. With the use of a percussive impulse, the frequency can transmit through these anatomical obstacles to affect the C1 transverse process.

A Gentle Approach

For over 125 years, chiropractic adjustments have been performed with varying amounts of force. Some struggle to comprehend how an EPIC sound wave is enough force to change the craniocervical alignment. Here are reasons why the EPIC adjustment can be so gentle:

- Patient is in a side-lying position; therefore, gravity is not counteracting the adjusting force.
- With patient in a side-lying position, the 10-14lb skull weight is not pressing down into the joints.
- Patient is positioned to immobilize the skull so that C1 can easily move around the adjoined occipital condyles.
- Patient is positioned in a unique, customized manner to reduce resistance within the craniocervical joints.
- Patient does not subconsciously guard for the adjustment, as it occurs in normal range of motion, without movement of the patient’s head or neck, and without any physical force.
- Patient also does not guard against the treatment because there is no pain with an EPIC adjustment.
- The adjusting line of drive is customized to the exact and unique coordinate measured for each patient based on their genetic asymmetries, anomalies and misalignments, thereby increasing accuracy which requires less force to move the anatomy.

Evidence-Based Outcomes

Immediately following the EPIC treatment, the neurophysiology begins to change. Evidence of this change be the patient’s body begins untwisting, the low back myotonicity begins to normalize, and the leg length begins to balance. Subsequently, the posture begins normalizing, the head and neck begin to straighten in relation to the body, the lateral pelvic shift improves, and the biomechanics of the weight-bearing joints begin to improve (Figure 11). Every patient is post x-rayed immediately after their first EPIC adjustment. These x-rays are taken with the same procedures as the original and are measured in the same method of analysis. The new alignment is assessed to determine the effectiveness of the adjustment and adequacy of structural repositioning (Figure 12).

Figure 11

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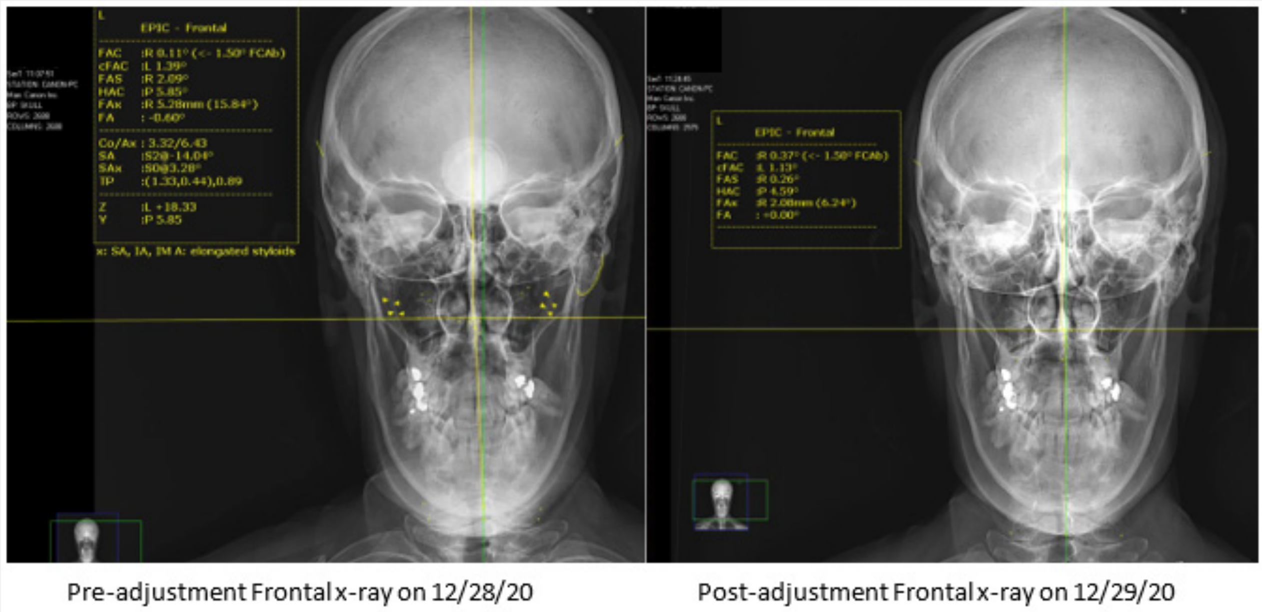

Figure 12

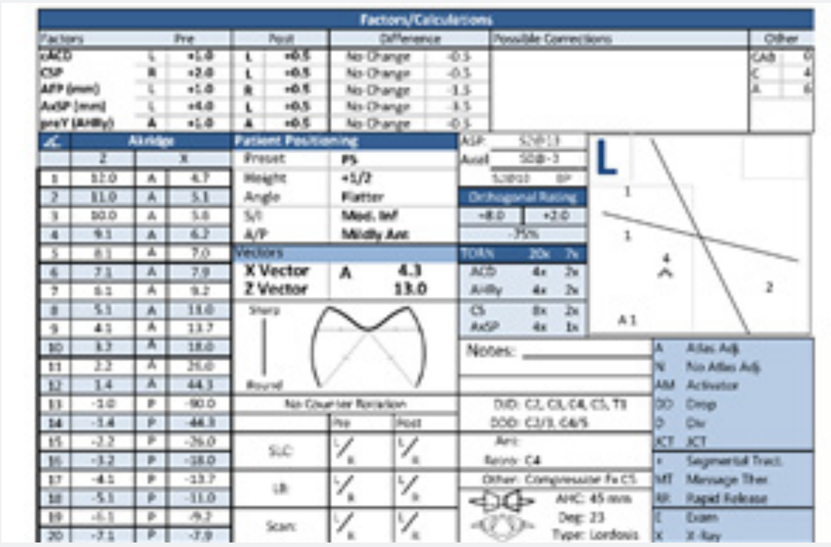

Figure 13

These before and after measurements are entered into EPIC's software program called **Sonus Blueprint.** This program quantifies and compares all structural relationships to assess the adequacy of misalignment reduction with the EPIC adjustment. From the post x-ray interpretation, Sonus Blueprint will help guide the doctor on what modifications need to be made, if any, in future adjustments of that patient to obtain an even better correction. Each doctors' results are tracked and compared with those results of other EPIC practitioners. From these results, EPIC is able to ascertain a measurable standard of care by which all doctors practicing EPIC can be held accountable. EPIC is also able to introspect the outcomes to determine refinements in the protocols of care inside the EPIC technique. Sonus Blueprint also tracks demographics, chief complaints, neurophysical examination findings, radiographic structural findings, genetic asymmetries, and much more. This information can be cross correlated on an international platform for seemingly limitless research studies and can easily be compared with additional patient outcome assessments (Figure 13).

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Holding

The EPIC spinal alignment procedure is expected to correct the craniocervical subluxation with the very first treatment. Variables that could affect how long the alignment will remain in proper position include:

- time necessary for soft tissue morphology around the new structural alignment
- patient not protecting their craniocervical junction following the procedure
- patient experiencing a trauma

However, the EPIC procedure has four unique benefits in its application that tend to allow the alignment to "hold" for exponentially longer periods of time compared to traditional chiropractic care. These benefits include:

- the correction removes all four misalignments simultaneously and instantaneously
- the correction aligns a patient into their genetically normal position
- the correction improves/restores the vertical center of gravity of the skull over the neck
- the correction preserves the integrity of the ligamentous support system by maintaining all adjusting force applications to be performed within a patient's normal range of motion.

Due to these factors, patients tend to maintain ("hold") the EPIC spinal correction for longer and longer periods of time compared to traditional spinal manipulative care. EPIC is a chiropractic procedure that should be viewed as a corrective adjusting procedure that works to provide longevity of positive patient outcomes, rather than as a short-term relief therapy. As the craniocervical alignment stabilizes and holds its correct position for longer periods of time, mechanoreceptor feedback loops can balance, postural erector muscles can then balance, the full spine has the opportunity to untwist and center, which can have a significant positive effect on intervertebral spinal discs and weight bearing joints as they regain their biomechanical stability.

Collaboration

Although the EPIC procedure has a powerful stand-alone value, it has a unique ability to integrate well with most other supportive treatments. EPIC is not intended to be used to compete with other chiropractic or medical procedures, but rather to co-manage cases for the sake of the patient. There are significant potential benefits to other physicians co-managing/co-treating cases with EPIC.

Benefits in the areas of diagnostic accuracy and treatment outcomes include, but are not limited to:

Diagnostic accuracy

- Neurologic assessments taken caudal to the craniocervical region could have a greater diagnostic accuracy without the neurological irregularities caused by the craniocervical subluxation.
- Vascular assessments for intracranial blood flow could potentially be more accurate without altered hemodynamics of the vertebral artery or internal jugular vein associated with a craniocervical subluxation.
- Imaging studies assessing the cerebrospinal fluid flow and associated intracranial pressure levels could be more accurate without the potential CSF disruptive sequelae of a craniocervical subluxation.
- Vascular assessments to screen for, and causation determination of, systemic high blood pressure or secondary vascular restrictions may be more accurate in the absence of a craniocervical subluxation.

Treatment efficacy

- With an untwisting spine due to improved bilateral spinal muscle balance from EPIC craniocervical care, secondary **spinal adjusting procedures** used to treat other full spine considerations may be even more effective. Secondary spinal misalignments may correct with less overall resistance and may have an increased propensity to maintain proper alignment as well.
- Any **muscular treatments** (i.e. massage therapy, neuromuscular therapy, physical therapy) for hypertonicity/spasm may show a significant improvement in response to treatment as the mechanoreceptor balance to those muscles improves with maintaining proper craniocervical alignment. Muscle tone is controlled by nerves, and nerves are protected by proper alignment of the spine.
- As the spine uprights with an improving vertical center of gravity on the circular fibers and nucleus of the spinal disc, **disc treatments** designed to address disc bulge and/or herniation may demonstrate a significantly more favorable response following the use of EPIC.
- **Physical therapy** attempting to rehabilitate the stabilizing muscle groups around a joint may discover patients responding more quickly to the therapy, if the neuro-stimulatory control of the associated muscles is unobstructed due to adequate craniocervical alignment. Additionally, it is logical to assume that physical therapy for improving the health and integrity of weight bearing joints should respond more favorably with equal, bilateral weight distribution to the lower extremities and balanced posture associated with proper craniocervical alignment.

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- **Vascular treatments** designed to improve intracranial blood flow should be more effective without the hemodynamic disruptions associated with a craniocervical subluxation.

Conclusion

EPIC is a chiropractic technique that utilizes neurology, physics, engineering and technology to analyze and correct the craniocervical alignment. Accurate alignment of the craniocervical junction can positively affect many neurovascular and biomechanical functions throughout the body, and EPIC is therefore a logical assessment and treatment option to help improve patient outcomes with many diverse conditions. It is plausible that EPIC can exist in any healthcare setting and is able to effectively co-manage cases with parallel treatment models. As EPIC is focused on the use of progressing technology, positive patient outcomes, and a measurable standard of care, the EPIC technique is advancing the chiropractic profession forward into the evidence-based model of care that the healthcare community is looking for and that the public deserves. As with all research, more studies are needed comparing this method with others, as well as the corresponding effect of neurovascular improvements on various conditions.

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The Use of Craniocervical Alignment Procedures in the Management of Brain Deterioration Disorders

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Opinion

During the last 20 years, there has been a significant rise in the prevalence of various brain deterioration diseases and the associated public awareness surrounding such conditions. Labels of cognitive dysfunction can include anything from basic diagnosed conditions such as ADD, ADHD, and various "brain fog" disorders, to the more severe levels of brain and cognitive deterioration such as Dementia, Parkinson's, Alzheimer's, Multiple Sclerosis (MS), Amyotrophic Lateral Sclerosis (ALS), Chronic Traumatic Encephalopathy (CTE), elements of Traumatic Brain Injury (TBI), and Post Traumatic Stress Disorder (PTSD). Yet, as the number of cases of cognitive impairment climbs, determination of definitive causation continues to evade researchers and physicians alike.

When discussing the treatment and management of all cognitive impairment conditions, cerebral hemodynamics is a critical factor that must be considered in ensuring that the brain is receiving and discharging adequate blood flow. If the brain is not receiving adequate blood flow from the arteries, then it will become undernourished and have the potential for deterioration. If the brain is unable to discharge the hypoxic blood out of the brain through the venous system, there is also the potential for deterioration. Inadequacies of the venous drainage system can also cause an increase in the brain's internal vascular pressure which can negatively impact the neurotoxin filtration and removal process of the cerebrospinal fluid (CSF) pump.

The upper cervical spine directly interacts with various elements of the vasculature responsible for providing and maintaining adequate cerebral hemodynamics. The internal carotid artery (ICA) and the internal jugular vein (IJV) are located immediately anterior to the upper cervical vertebrae, and the vertebral artery transcends through the transverse foramen of the upper cervical vertebrae. With numerous research articles demonstrating the potential for vascular alterations due to vertebral structural indenting of the vessels, it appears that abnormal upper cervical alignment may influence cerebral hemodynamics.

Additionally, elongation of the styloid process may affect the ICA and IJV flow and alter cerebral hemodynamics. Whether due to structural elongation or calcification of the stylohyoid ligament, this condition is known as Eagle's Syndrome when the styloid elongation affects regional neurology. Eagle's Syndrome has been noted in medical research journals as a relatively rare occurrence; however, preliminary results of recent large scale research studies appear to be discovering styloid process elongation down to the level of the transverse process of the top cervical vertebra (C1) to be quite common. One preliminary study out of South Carolina in 2021-2022 of 200 cases discovered elongation of the styloid process(es) down to the level of C1 vertebra transverse process at a prevalence of 80% or higher by multiple investigators, and a separate preliminary US national clinical study by multiple investigators of over 3,000 cases from 2017-2020 demonstrated a prevalence of over 50%. It appears that styloid process elongation is much more common than previously thought.

If the styloid process is more commonly developed down to the level of the C1 transverse process, then there are 2 potential vascular compressions that can occur. First, if the C1 vertebra is subluxated (misaligned) in a manner that includes a rotational component, then the transverse process may press the IJV into the backside of the elongated styloid process. Second, if the patient with elongated styloid process(es) spends time in a position of craniocervical flexion, then the styloid process(es) can press back into the IJV causing additional compression.

With the constant neck flexion associated with the technology age of texting, gaming, and computer desk work, the potential increase in IJV compression between a subluxated C1 vertebra and elongated styloid processes could alter cerebral hemodynamics and may be a significant contributing factor to an increasing prevalence of brain deterioration diseases.

A 2020 study backed by the Rollins School of Public Health currently under peer-review, showed a prevalence of 79% of the cohort had a craniocervical subluxation. This is likely representative of a potentially much larger cohort predisposed to cognitive dysfunction due to an uncorrected craniocervical subluxation. The epidemiological impact of this altered cerebral hemodynamics may extend far beyond presently known morbidity and mortality correlations.

Structural alignment procedures that can effectively improve the vascular compression syndrome of the craniocervical region may have a positive impact on recovery and prevention of degenerative cerebral disorders. The structural alignment procedures focused on correcting the craniocervical alignment are primarily found within the chiropractic profession. Due to the sensitivity of the neurovasculature in the craniocervical region, as well as the anatomical uniqueness of the absence of cervical discs and interlocking posterior facet joints in that region, procedures used to correct craniocervical alignment should be applied gently, non-invasively, and within the patient's normal range of structural motion whenever possible.

Determination of the presence of elongated styloid processes as well as accurate determination of the measurable malposition of craniocervical vertebral alignment and the associated appropriate directional realignment, make diagnostic imaging an essential component for determining the safest and most effective craniocervical alignment procedures. The absence of such imaging could place the practitioner in a position of lacking necessary data for determining appropriate treatment and could increase the potential for patients to experience adverse reactions.

Conclusion

In conclusion, the determination of craniocervical subluxation and the effective use of craniocervical alignment procedures may have a significant and positive effect on improving the cerebral hemodynamics of a large portion of the population and should be a standardized component in the evaluation and management of cognitive dysfunction syndromes.

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