EC NEUROLOGY
Case Report

# Advanced Diagnostic Imaging Refines EPIC Technique Spinal Procedure to Resolve Cervicogenic Dizziness

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**Received:** April 30, 2026; **Published:** May 21, 2026

## Abstract

This report describes a 25-year-old female patient with vertigo attributed to cervicogenic dizziness (CGD). The case highlights the role of craniocervical spinal alignment using the Evolutionary Percussive Instrument Corrections (EPIC) spinal procedure. Initial evaluation using conventional digital radiography identified C1 vertebral malalignment, and EPIC-guided intervention resulted in transient symptomatic improvement with recurrent instability. Due to lack of sustained response, cone-beam computed tomography (CBCT) was subsequently performed, providing enhanced three-dimensional visualization of craniocervical anatomy and more precise localization of the C1 transverse process. Adjustment targeting based on CBCT findings was associated with improved alignment stability and sustained reduction in vertigo symptoms. This case suggests that CBCT may improve targeting accuracy in biomechanically guided spinal procedures, and may be associated with more durable symptom improvements in select patients with CGD. Further studies are needed to determine the generalizability of these findings and to define appropriate indications for advanced imaging in the management of cervicogenic dizziness.

***Keywords:*** *Cervicogenic Dizziness (CGD); Craniocervical Malalignment; Cone-Beam Computed Tomography (CBCT); Image-Guided Intervention; Cervical Spine; Diagnostic Imaging*

## Abbreviations

CGD: Cervicogenic Dizziness; EPIC: Evolutionary Percussive Instrument Corrections; CBCT: Cone-Beam Computed Tomography; ICA: Internal Carotid Artery; FLLD: Functional Leg Length Discrepancy

## Introduction

Cervicogenic dizziness (CGD) is a clinical syndrome characterized by dizziness, imbalance, or vertigo arising from dysfunction of the cervical spine. It is considered a diagnosis of exclusion, and is often associated with abnormal proprioceptive input from cervical structures, particularly at the craniocervical junction, which can disrupt vestibular integration and spatial orientation [6-8]. Despite increasing recognition, the condition remains challenging to diagnose due to overlapping symptomatology with primary vestibular, neurologic, and vascular disorders, as well as the absence of definitive diagnostic criteria.

The craniocervical junction, including the occiput (C0), atlas (C1), and axis (C2), plays a critical role in neurovascular and proprioceptive signaling. Subtle biomechanical alterations in this region have been thought to influence adjacent neurovascular structures, including the internal jugular vein (IJV), carotid artery, and vagus nerve, potentially contributing to dizziness and autonomic symptoms [3,4]. Therapeutic approaches aimed at restoring craniocervical alignment have been proposed as potential interventions in selected cases of CGD, with prior reports suggesting improvement in dizziness following cervical-specific interventions [9,10]. Among these, the Evolutionary Percussive Instrument Corrections (EPIC) technique utilizes mathematically calibrated, soundwave-based impulses to achieve targeted spinal realignment based on coordinates derived from craniocervical imaging [2,5].

Accurate identification of anatomic landmarks is key to the precision of such biomechanically guided interventions. Conventional digital radiography is widely used as a first-line imaging modality due to its accessibility and cost-effectiveness. However, its two-dimensional nature may limit accurate localization of complex three-dimensional structures, particularly in the craniocervical region. Cone-beam computed tomography (CBCT) offers high-resolution, three-dimensional imaging with improved visualization of osseous anatomy and spatial relationships, and has been increasingly utilized for spinal applications. Current evidence suggests that CBCT may enhance diagnostic accuracy while maintaining radiation exposure comparable to or lower than traditional radiographic techniques [11,12]. However, there remains limited clinical evidence directly comparing the impact of imaging modality on procedural accuracy and clinical outcomes in patients undergoing alignment-based interventions for CGD. Notably, it is unclear whether advanced imaging techniques such as CBCT can meaningfully alter treatment targeting and improve durability of symptom improvements compared to conventional radiography.

## Case Presentation

A 25-year-old female presented with complex vestibular and neurologic symptoms of insidious onset. She reported constant dizziness, episodic vertigo, and nausea, with episodes occurring unexpectedly and often without identifiable triggers. Over the 45 days preceding her initial upper cervical evaluation, the patient's symptoms progressively intensified to a continuous, self-reported 10/10 level of dizziness. She described marked disruption in daily function and activity, experiencing difficulty standing, walking, driving, sleeping, and accomplishing basic household tasks, whereas even slight head positional changes could provoke dizziness. These episodes of CGD frequently began during routine conversations and were severe enough that she often required another driver to follow her vehicle for safety. She reported nocturnal episodes occurring 2 - 3 times per night, particularly when lying on or turning toward the right side. Meclizine had been trialed prior to chiropractic intervention but failed to provide any symptomatic relief, suggesting that the dizziness is not attributable to mechanisms typically responsive to vestibular suppressants.

A neurovascular physical examination was performed using EPIC technique protocols and revealed indicators consistent with craniocervical dysfunction and associated CGD. These findings included unilateral edema in the right suboccipital region overlying the C2 dorsal root ganglion, as well as altered neuromuscular regulation, including reduced right arm flexion strength with increasing demand. Grip strength testing demonstrated asymmetry; with the head in a neutral position, grip strength measured 47 lbs in the right hand (dominant) and 54 lbs in the left hand. With left head rotation, right hand strength increased to 70 lbs. Additional findings included altered neuromuscular regulation of lower back postural muscles in the supine position, characterized by hyperactivity of the right lumbar erectors resulting in a functional leg length discrepancy, with the right leg approximately ½ inch shorter than the left. The Fukuda stepping test performed over 60 seconds demonstrated forward and rightward translation, along with a 45-degree rotation to the right.

A four-view pre-adjustment digital radiographic series of the craniocervical region was obtained and analyzed using EPIC technique protocols. The patient's epigenetic structural profile was ascertained, along with multidimensional vertebral malalignments between the occiput (C0), atlas (C1), and axis (C2), as well as the angle of lower cervical deviation (i.e. malalignment profile). For the purposes of this report, the malalignment profile is simplified to focus on the C1 vertebra, which demonstrated a lateral displacement to the left side (+θZ 0.7 degrees) and a rotational displacement of +θY 1.52 degrees (Figure 1). Additionally, the C1 transverse process contact point for the EPIC soundwave impulse procedure was identified (Figure 2).

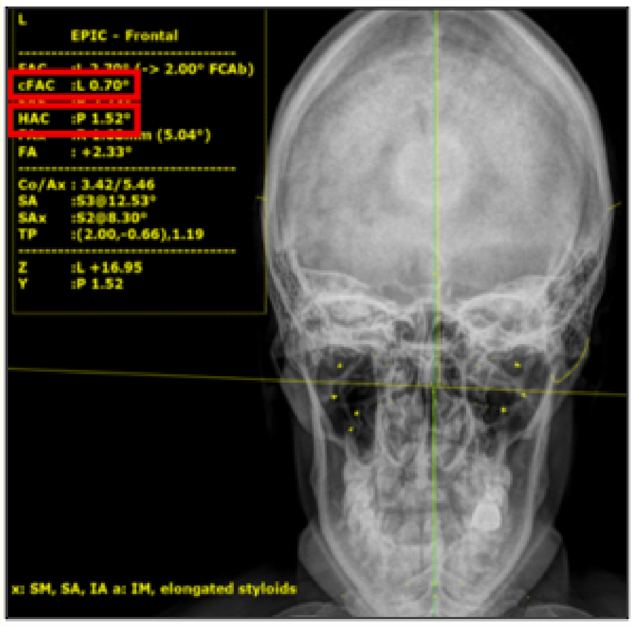


***Figure 1:*** *Pre-adjustment radiograph showing C1 lateral (+θZ 0.7°) and rotational (+θY 1.52°) displacement.*

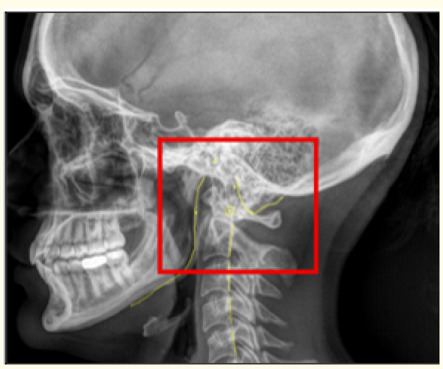

***Figure 2:*** *Pre-adjustment radiograph showing the C1 transverse process contact point for EPIC targeting.*

Numerous epigenetic variations were also present, most notably bilateral elongated styloid processes extending to the level of the C1 transverse processes. The combination of neurovascular indicators and measurable radiographic biomechanical malalignment was consistent with a diagnosis of craniocervical alignment abnormality ("subluxation" as defined in prior literature) [1]. Based on both epigenetic and malalignment profiles, a single correction vector was calculated in accordance with EPIC technique spinal procedure methodology [2].

The radiographic findings demonstrated a measurable C1 vertebral malposition of +θZ 0.7 and +θY 1.52 degrees, indicating a left/posterior displacement of the C1 vertebra, with corresponding anterior rotational positioning of the right C1 transverse process. Given that the IJV, internal carotid artery (ICA), and vagus nerve are anatomically located anterior to the C1 vertebra, this anterior displacement on the right could potentially influence adjacent vascular structures. Additionally, prior data have noted that the IJVs are often larger on the right side [3], and given that venous structures are more susceptible to external compression, it is possible that IJV compression may occur in the setting of C1 rotational malalignment.

The vascular findings on examination revealed edematous buildup in the right suboccipital region. This has been described as Ganglion Compartment Syndrome, and may occur in the setting of IJV or vascular obstruction [4]. In this case, measurable anterior displacement on the right side of C1 was associated with right suboccipital edema.

The patient received a single soundwave impulse corrective treatment to the craniocervical region (Figure 3) in accordance with EPIC technique protocols, using the Integrity Genesis adjusting instrument (Figure 4) [5]. The impulse was applied to the left C1 transverse process from a left/posterior degree-specific line of drive. Immediately following the initial correction, the patient was re-evaluated for the presence of alignment abnormality using the EPIC neurovascular physical examination and radiographic assessments. Findings demonstrated a significant reduction in right suboccipital edema based on both palpatory and subjective discomfort indicators. Lumbar erector neuromuscular imbalance normalized, and functional leg length discrepancy (FLLD) resolved. A two-view post-adjustment radiographic study was then obtained and demonstrated measurable improvement in biomechanical malalignment.

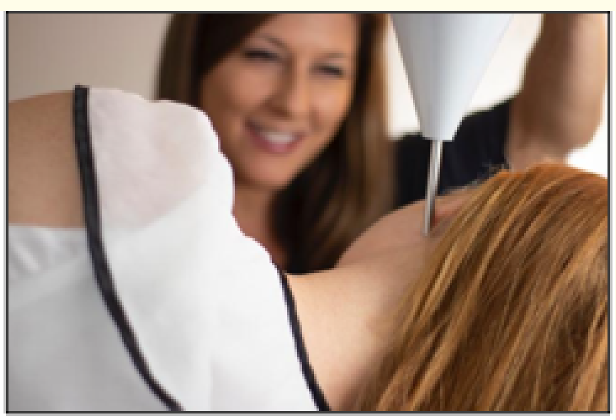

***Figure 3:*** *EPIC soundwave impulse treatment to the craniocervical region.*

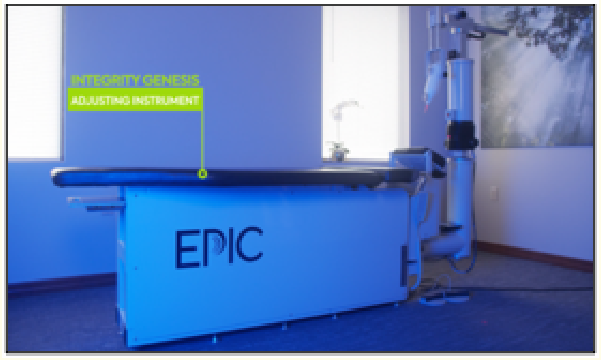


***Figure 4:*** *Integrity Genesis adjusting instrument used for EPIC soundwave impulse delivery.*

The patient was evaluated the following day, and neurovascular indicators revealed no evidence of upper cervical malalignment. The patient reported a significant reduction in vertigo, describing the improvement as "immediate and profound." However, within two days, the vertigo returned at a reduced intensity of 6/10, and neurovascular examination again indicated recurrence of upper cervical malalignment. A second soundwave impulse treatment was applied using the original radiographic data, after which neurovascular indicators improved again, and the patient reported a similar symptom response. The biomechanical realignment appeared to correlate with reduction in CGD symptoms, as described in prior studies [6-10]; however, symptoms recurred again after six days.

Due to recurrence of vertebral malalignment and associated vertigo symptoms, a repeat radiographic evaluation was performed. The new radiographs demonstrated that the C2 rotational malalignment (+θY) had increased from 1.52 to 3.01 degrees. The updated alignment coordinates were calibrated into the adjusting instrument, and a soundwave impulse was administered. Neurovascular indicators improved, and the patient reported noticeable symptomatic improvement once more. However, over the next three consecutive office visits within a two-week period, an alignment procedure was required at each visit.

A repeat radiograph was performed to evaluate the reason for the increased number of adjustments, with findings revealing that the +θY value had increased to 3.24. An adjustment was performed using this updated coordinate. Neurovascular indicators improved, and the patient reported a positive symptomatic response in vertigo yet again. However, within 5 days, neurovascular examination findings returned.

Due to lack of improved alignment stability, along with two consecutive radiographs demonstrating an increase in +θY rotational malalignment, criteria were met to pursue an alternative imaging approach. A CBCT scan of the patient's craniocervical spine was obtained. The CBCT dataset demonstrated higher anatomic clarity via three-dimensional voxel-based bone detail compared to two-dimensional radiographic images. The two most significant clinical findings included malformation of the occipital condyles in their anterior-to-posterior development (Figure 5) and improved delineation of the C1 transverse process contact point (Figure 6).

Because the CBCT image more clearly identified the C1 transverse process location as being more posteriorly positioned than suggested by the radiographic image, the soundwave instrument had likely been targeting too far anterior to the left C1 transverse process. Although the instrument was calibrated for a posterior line of drive to address the +θY displacement, this anterior targeting may have resulted in a diverging soundwave impacting the C1 transverse process from an anterior vector. This may help explain the increasing posterior (+θY) malalignment observed on subsequent radiographs. Accordingly, the adjusting impulse instrument of the EPIC technique spinal procedure was then targeted based on the location identified on the clearer CBCT image.

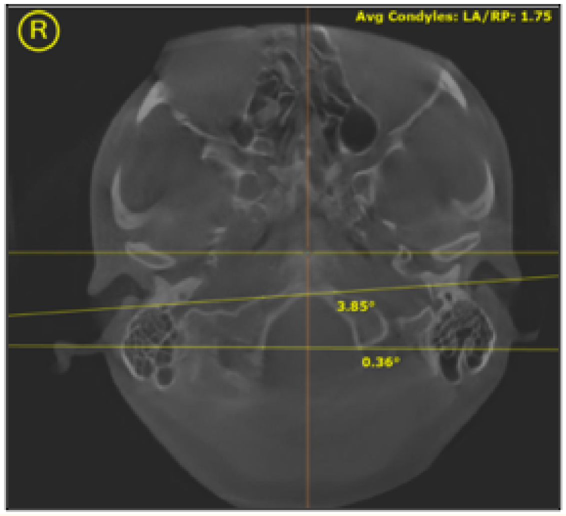


***Figure 5:*** *CBCT image demonstrating malformation of the occipital condyles.*

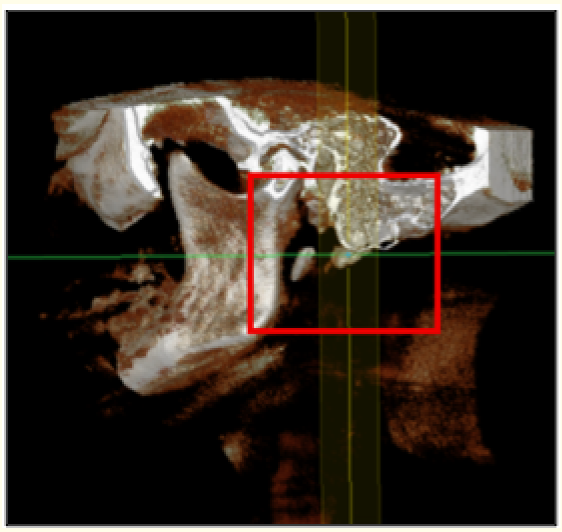

***Figure 6:*** *CBCT image demonstrating delineation of the C1 transverse process contact point.*

Following the updated targeting accuracy based on CBCT, neurovascular indicators improved once more, but this time the patient reported significant differences. Namely, she reported immediate and marked improvement following the CBCT-guided adjustment. Symptoms did not recur within the usual 24 - 48 hours window. Instead, the patient experienced sustained relief, describing herself as feeling "almost completely back to normal," with only mild residual dizziness that did not impair daily activity. Her mild dizziness was presumed to reflect physiologic adaptation within the recovery process rather than persistent dysfunction. Over the next five consecutive EPIC neurovascular examinations across a six-week period, there was no indication of upper cervical malalignment (Figure 7). The patient no longer reported significant dizziness episodes.

| Visit Date | # Days Between Visits | ADJ: Y/N | Imaging Involve |
|---|---|---|---|
| 08/25 | | Y | New X-Ray |
| 08/26 | 1 | N | Post X-Ray |
| 08/26 | 0 | N | N/A |
| 08/28 | 2 | Y | Old X-Ray |
| 09/03 | 6 | Y | New X-Ray |
| 09/04 | 1 | Y | Old X-Ray |
| 09/08 | 4 | Y | Old X-Ray |
| 09/11 | 3 | Y | Old X-Ray |
| 09/18 | 7 | Y | New X-Ray |
| 09/22 | 4 | N | N/A |
| 09/23 | 1 | Y | CBCT |
| 09/25 | 2 | N | N/A |
| 09/29 | 4 | N | N/A |
| 10/07 | 8 | N | N/A |
| 10/14 | 7 | N | N/A |
| 11/04 | 21 | N | N/A |

***Figure 7:*** *Follow-up EPIC neurovascular examination demonstrating absence of upper cervical malalignment.*

## Discussion

Because the EPIC technique spinal procedure relies on precise craniocervical alignment with mathematically calibrated treatment delivery (within 1/100th of a degree), the treatment impulse is targeted to a location identified on digital imaging. If this location is misidentified, it may alter the intended treatment outcomes. The C1 transverse process contact point was identified on sagittal cervical radiography as 15.54 mm posterior to the mandible (Figure 8), whereas CBCT identified the same landmark at 19.5 mm posterior to the mandible (Figure 9). This represents an approximate 4 mm difference in targeting location.

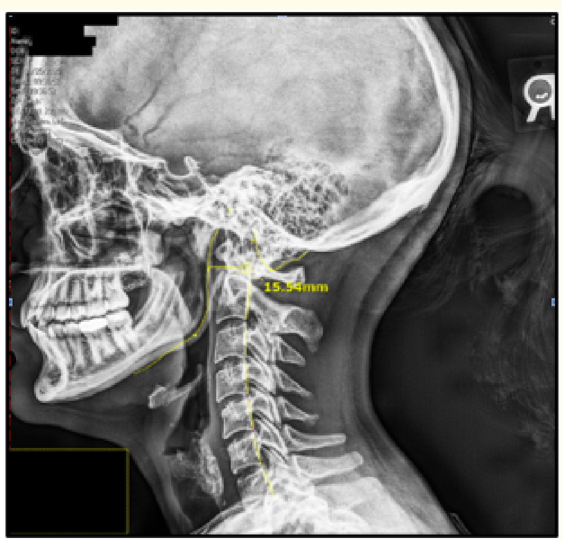


***Figure 8:*** *Sagittal cervical radiograph demonstrating localization of the C1 transverse process contact point.*

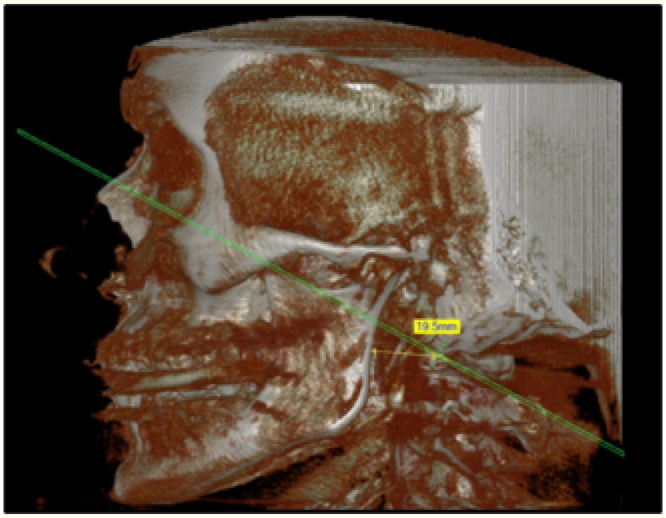

***Figure 9:*** *CBCT image demonstrating localization of the C1 transverse process contact point.*

CBCT measured tissue depth at the C1 level as 19.9 mm from the skin surface to the transverse process (Figure 10). Based on the initial radiographs, the coordinate application for correction was 16.95 degrees in the superior-to-inferior angle and 1.52 degrees in the posterior-to-anterior angle. These parameters would have guided targeting as illustrated (Figure 11).

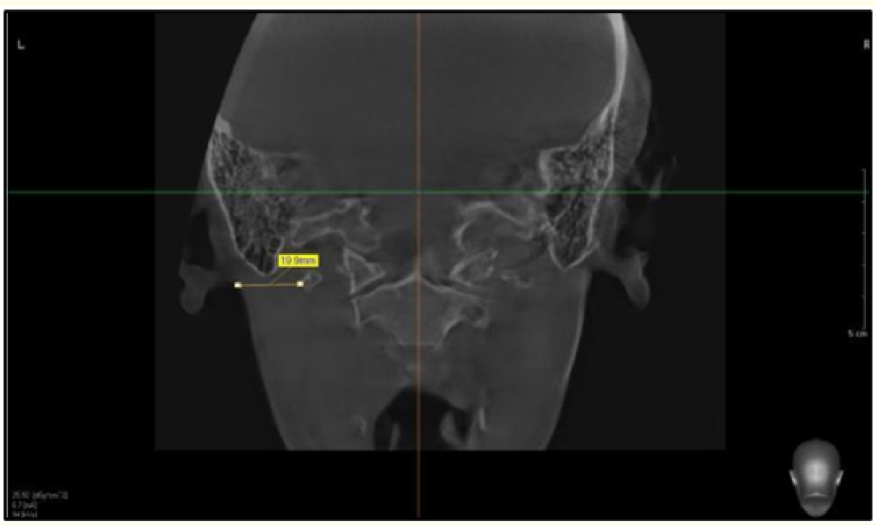


***Figure 10:*** *CBCT image demonstrating tissue depth measurement at the C1 level (19.9 mm from skin surface to transverse process).*

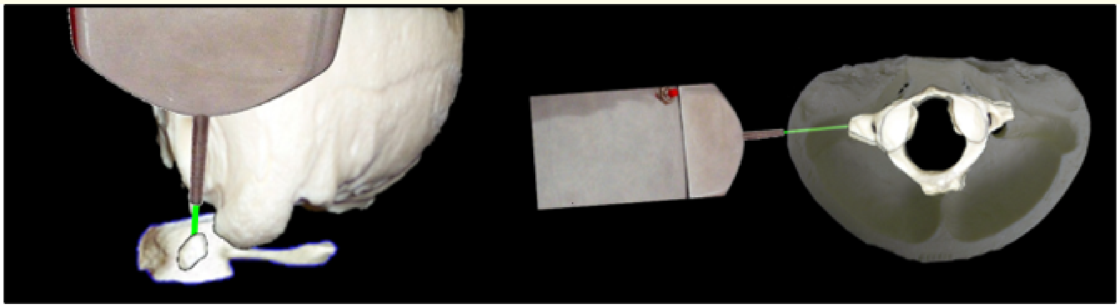

***Figure 11:*** *Angles for coordinate-based targeting.*

Considering a tissue depth of 19.9 mm and a 4 mm difference in the actual location of the C1 transverse process, this would correspond with an angular error of force delivery of 11.37 degrees. When applied to an instrument calibrated at a posterior angle of 1.52 degrees, the force reaching the actual transverse process location would instead be directed from an anterior angle of 9.85 degrees, rather than the intended posterior 1.52 degrees as shown below (Figure 12).

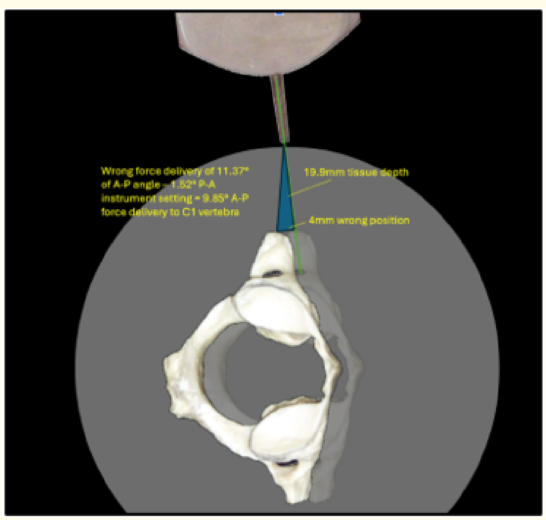


***Figure 12:*** *Angular error of force delivery.*

With force delivery occurring from an anterior rather than posterior direction, this may help explain the measurable increase in C1 posteriority observed on follow-up imaging. When the correct C1 transverse process location was identified using CBCT and appropriate calibration and targeting were applied, treatment outcomes improved. Clinical neurovascular indicators normalized and remained stable for over five weeks, and the patient reported significant, sustained improvement in vertigo symptoms.

Overall, this case highlights the potential role of CBCT as a precision-enabling imaging modality in the evaluation and treatment of CGD. While conventional radiography remains the standard first-line approach due to accessibility and cost, its two-dimensional limitations may be insufficient for accurately localizing complex three-dimensional anatomy at the craniocervical junction. In this patient, radiographic estimation resulted in a measurable targeting discrepancy associated with treatment instability and symptom recurrence. In contrast, CBCT-based localization provided improved anatomic clarity, which was associated with more accurate biomechanical targeting and more durable clinical improvement. Our findings suggest that CBCT may have a selective role in cases characterized by severe or persistent symptoms, suspected anatomic variation, or lack of sustained response to standard imaging-guided interventions. In such contexts, CBCT may increase precision by more accurately defining anatomic landmarks critical to targeted therapeutic delivery. From a broader clinical and policy perspective, this supports a targeted, indication-based approach to advanced imaging, rather than routine clinical use.

Emerging literature suggests that CBCT can provide enhanced structural detail, with radiation exposure comparable to, or in some cases lower than, traditional radiographic series [11,12]. Although CBCT involves higher upfront cost, improved targeting accuracy may decrease the need for repeat interventions and prolonged treatment courses, aligning with value-based care principles. This case supports the concept that precision imaging may influence therapeutic accuracy and durability in biomechanically guided spinal care.

## Limitations of the Study

The use of CBCT-guided targeting in this report was limited to a single case. Its clinical utility and generalizability must be further evaluated through larger, controlled, and randomized studies to validate these findings. Additionally, the reliance on subjective symptom reporting for vertigo introduces the potential for response bias and placebo effects. To help contextualize these outcomes, serial imaging and neurovascular examination findings were used as adjunctive, more objective indicators of treatment response.

## Conclusion

This report demonstrates that inaccurate localization of the C1 transverse process using two-dimensional radiography may result in systematic targeting error during biomechanically guided spinal interventions. In this patient, CBCT enabled a more precise three-dimensional visualization of cervical anatomy, resulting in treatment targeting that was associated with improved alignment stability and more robust symptom relief. These findings suggest that CBCT may have utility for recurrent malalignment in patients with inconsistent response to radiography-guided procedures. Further large-scale, blinded, and randomized studies are warranted to better understand the role of CBCT-guided targeting for CGD, as well as define appropriate utilization criteria, quantify cost-effectiveness, and establish standardized protocols.

## Acknowledgements

We the authors appreciate the expert edits of Margaret A. Madigan.

## Ethics Statement

The patient provided written informed consent for participation in this report and for the publication of de-identified data and any accompanying images. Patient confidentiality was maintained in accordance with applicable privacy regulations, including the Health Insurance Portability and Accountability Act (HIPAA). The patient was informed of the potential risks and benefits of the diagnostic imaging and therapeutic interventions performed, including radiography, CBCT, and EPIC technique spinal procedures.

## Conflict of Interest

The study authors declare that this research was conducted in the absence of any financial or commercial relationships that could be construed as a potential conflict of interest.

## Author Contributions

SP conceptualized the study. The original draft of this manuscript was written by SP. Data acquisition, analysis, and interpretation were performed by SP. Review and additional editing of the manuscript were conducted by KUL, KB, PRC, IE, RDB, AD, RKAF, SS, JPB, DB, ZC, KS, MO, YTL, and MPL. This manuscript has been approved by all authors.

## Funding Support

- R21 DA045640/DA/NIDA NIH HHS/United States.
- R33 DA045640/DA/NIDA NIH HHS/United States.
- R41 MD012318/MD/NIMHD NIH HHS/United States.

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**Volume 18 Issue 5 May 2026**