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Atlas Orthogonal Chiropractic Management of Trigeminal Neuralgia: A series of case reports.

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Corresponding Author:	Joseph James Ierano, BSc DC Palmer College of Chiropractic Narellan Vale, NSW AUSTRALIA
First Author:	Joseph James Ierano, BSc DC
Order of Authors:	Joseph James Ierano, BSc DC
	Dennis Milverton Richards, PhD
Suggested Reviewers:	Donald McDowall, PhD Adjunct Fellow, Southern Cross University d.mcdowall.12@student.scu.edu.au Knowledge of topics
	Stephen Myers, PhD Professor, Southern Cross University stephen.myers@scu.edu.au in depth diverse knowledge

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Dear Editor(s):

Please find uploaded the original research article titled ‘Atlas Orthogonal Chiropractic Management of trigeminal neuralgia: A case series.’

Thank you for your kind consideration in its possible publication.

Sincerely,

Joseph Ierano BSc DC
Corresponding author
Joe@ierano.com

Atlas Orthogonal Chiropractic Management of Trigeminal Neuralgia:
A series of case reports.

Joseph J. Ierano (corresponding author)[a]

Dennis M. Richards[b]

a. 28 Manna Gum Road, Narellan Vale NSW 2567 Australia. E: joe@ierano.com

b. PO Box 718 Tweed Heads Qld 2485 Australia. E: dennis.richards@scu.edu.au

ABSTRACT

Context
Trigeminal neuralgia is a debilitating facial pain condition. Upper cervical chiropractic care has been mentioned as a possible solution

Objective
To determine the effects of Atlas Orthogonal upper cervical chiropractic technique adjustments on trigeminal neuralgia sufferers

Design
Case series

Setting
A private chiropractic practice

Participants
Five persons with chronic, severe, daily trigeminal neuralgia pain, radiological findings of significant head tilt, pain upon upper cervical palpation, and supine leg length inequality

Interventions
Up to two consultations and/or Atlas Orthogonal adjustments a week for eight weeks

Outcome measures
Self-reported reduction in trigeminal neuralgia pain and changes in radiological findings, sensitivity to upper cervical palpation, and leg length inequality

Results
Four participants reported reduced trigeminal neuralgia pain, including two with complete cessation of pain. Three participants reduced medication dosages. One reported no change

Key words:
Trigeminal neuralgia, medication, patients, chiropractic, symptoms

INTRODUCTION

Trigeminal neuralgia is a debilitating condition involving recurrent paroxysmal pain within the anatomical distribution of the fifth cranial nerve.[1,2] This nerve arises in the pons of the brainstem and provides sensory and motor innervation to the face.[3] The many complex structures and connections of the trigeminal system are not well understood.[4,5] Trigeminal neuralgia affects approximately twelve out of every 100,000 people and is more common in females.[1] The pain involved is usually unilateral, sharp, and with rapid onset and remission. Concomitant continuous dull or throbbing pain may also be experienced. Trigeminal neuralgia can be triggered by apparently innocuous stimuli, such as a touch of trigger zones on the face or may arise spontaneously. It may also disappear for unpredictable periods up to years. It is considered one of the most severe types of pain and commonly leads to serious anxiety, depression, time off work, and reduced quality of life.[6-8]

As there are no conclusive diagnostic procedures for trigeminal neuralgia, diagnosis of it is clinical and based mainly on symptoms such as facial, jaw, or tooth pain.[1,9] The etiology, pathophysiology, and long-term prognosis of trigeminal neuralgia are not clear.[5,10] As a result, numerous causes of trigeminal neuralgia have been proposed, as is reflected in the current classification of the condition into idiopathic, classical, or secondary trigeminal neuralgia.[1] *Idiopathic* trigeminal neuralgia is of unknown cause. *Classical* trigeminal neuralgia involves vascular compression by the superior cerebellar artery of the trigeminal nerve roots entry zone into the pons and morphological changes of the trigeminal nerve demonstrated on magnetic resonance imaging (MRI) or during surgery. Such compression may produce nerve root damage, focal demyelination, and deregulated membrane voltage-gated sodium channel expression. This situation may initiate stimulus-induced bursts of nerve hyperactivity, cross excitation of adjacent neurons, and sudden electrical activity build-up, resulting in the pain of trigeminal neuralgia.[2] Lastly, *secondary* trigeminal neuralgia involves demonstration by MRI or other tests of a condition able to cause neuralgia, such as arteriovenous malformation, tumor, or multiple sclerosis (which may be associated with bilateral trigeminal neuralgia via nerve demyelination).[11]

Many treatments of trigeminal neuralgia have also been tried, with most aimed at providing symptomatic relief.[10,12] Single attacks of trigeminal neuralgia are usually too abrupt and short for medical treatment to be applied. Long-term use of the anti-convulsant drugs carbamazepine or oxcarbazepine is usually the first line medical approach.[1,2,13] These drugs decrease neuronal activity and are prescribed on the basis of low to moderate quality evidence.[1,14,15] If these drugs are not effective,[12,16] and cause unacceptable side effects,[2,17-19] other drugs may be tried, or trigeminal neuralgia sufferers may be offered surgery from a range of procedures.[4,20] These include radiofrequency thermorhizotomy,[21] percutaneous balloon microcompression,[22] glycerol rhizotomy,[20] gamma knife radiosurgery,[2] and microvascular decompression surgery, the most commonly-used and invasive procedure.[2] microvascular decompression is based on the hypothesis that neurovascular compression on the trigeminal nerve root near the superior cerebellar artery may cause trigeminal neuralgia.[1] While a majority of patients have lengthy pain relief after microvascular decompression,[2] it should be noted that many classical trigeminal neuralgia cases show no evidence of neurovascular compression and many asymptomatic people have MRI evidence of such compression.[23] Nonetheless, as all these interventions involve risks and cost, and may fail to produce lasting results, there have been repeated calls for more research to establish safer and more effective approaches to clarify the cause/s of trigeminal neuralgia and help those experiencing it.[10,12,14,20,24,25]

However, most of these calls have referred to drug and surgical approaches. There may exist safe and effective approaches outside of medicine and surgery. For example, one study compared data available on the efficacy, side effects, and cost of acupuncture, carbamazepine, and microvascular decompression in addressing trigeminal neuralgia.[24] Acupuncture appeared to be more effective, safer, and less expensive that the other approaches. Chiropractic may also offer a useful approach outside of medicine and surgery.[26-30]

The premise of chiropractic is that subluxations in the spine and other articulations may interfere with nervous system regulation of body function and health.[31,32] Within the chiropractic context, subluxation has been described as "[A] complex of functional and/or structural and/or pathological articular changes that compromise neural integrity and may influence organ system function and general health."[33] Chiropractors use many different techniques in attempting to correct subluxations by adjusting the spine, usually by hand. However, some chiropractors use mechanical or electronic instruments to deliver adjustments.[34,35]

Given the complexity of the structures of the upper cervical spine,[36,37] and their importance in the connection between the brain and the spinal cord,[38] some chiropractic techniques focus on this area.[39,40] Some of these techniques use mechanical instruments to apply a corrective force to the atlas vertebra in a specific direction (vector). For example, Atlas Orthogonal technique uses a percussion instrument (Appendix 1) to deliver the adjustive thrust.[41] The precise vector of the Atlas Orthogonal thrust is calculated from line measurements termed roentgenometric values, which are drawn, measured, and analyzed on cervical spine x-ray studies specific to this technique.[32] (Fig. 1) The vector of the corrective force delivered to the atlas is determined by angular calculations within the right-handed cartesian coordinate system.[2] In this system, three straight mutually perpendicular and intersecting lines divide the body planes into regions about which the atlas can rotate and/or translate.[3] (Appendix 2) Abnormalities in the ideal relationships between these lines form the diagnosis of the atlas positional manifestation of subluxation that in turn indicates the required corrective vector.[40] The specific Atlas Orthogonal thrust is intended to realign the atlas to the orthogonal position relative to the head, the cervical spine, and the horizon, and to facilitate the removal of the subluxation's interference to nervous system function.[32,42]

Trigeminal neuralgia sufferers may have upper cervical subluxation.[43-45] Such misalignment may create a brainstem-related combination of abnormal neurological and tissue tone and vascular and cerebrospinal fluid flow.[38,42] These people may as a result experience extraordinary hypersensitivity to pain and other stimuli.[42] Low force non-manual spinal adjustment chiropractic techniques may therefore be particularly suitable in seeking to normalize the position of the head on the cervical spine and ease abnormal brainstem changes. This study reports on the use of Atlas Orthogonal chiropractic technique intended to correct atlas subluxations and to relieve trigeminal neuralgia.

PARTICIPANT INFORMATION

Five participants were recruited into the study. Of these, three were sourced via advertisement in the newsletter of a Sydney, Australia support group for trigeminal neuralgia sufferers.[46] The two other participants were referred to the first author's Atlas Orthogonal practice by other patients of the practice. Specific information on participants can be seen in Table 1.

Table 1: Participant information

Case	Age	Sex	**trigeminal neuralgia duration (years)**	**Other symptoms**	**Previous interventions**	**Visits/ interventions ratio***	**RV changes (degrees)**	**Outcomes**	**Medication regime after intervention**
1	52	F	2	Facial, neck, low back pain, headaches, hearing loss	Carbamazepine Vitamins Heat therapy	16:16	APL 1.0 > 0.5 ACD 1.0 > 2.0 CSL 5.0 > 3.0 18.3% better	TNPI increased before reducing to zero in final visits	Unchanged
2	64	M	3	Shoulder	Carbamazepine Exercise	9:9	AFP 2.5 > 0.5 ACD 2.0 > 2.0 CSL 1.5 > 4.0 37.5% better	TNPI reduced Shoulder pain reduced	Halved
3	72	F	15	Neck, shoulder pain, headache, tinnitus, chronic asthma	Microvascular decompression surgery over 12 months previously?	16:16	AFP 2.5 > 0.0 FCL 5.0 > 1.0 CSL 5.0 > 3.0 80% better	trigeminal neuralgia pain gone in five visits Remained under care for a year due to perceived benefits to wellbeing	None taken
4	60	F	16	Low back pain, headache, tinnitus	Medication	16:16	AFP 4.5 > 1.5 ACD 3.0 > 2.0 CSL 1.0 > 1.0 48% better	No change in TNPI Other symptoms reduced	Unchanged
5	68	F	18	Facial pain only	Carbamazepine Amitriptyline	16:11	AFP 1.0 > 1.5 ACD 1.0 > 0.5 CSL10.0 > 5.0 50% better	visual analog scale score from 10 to 0 in three interventions	Reduced by 83%

Minor recurrences of trigeminal neuralgia pain associated with neck pain disappeared after intervention

Notes: *Interventions were delivered on visits when Atlas Orthogonal protocols indicated that subluxation was present.
RV = roentgenometric values; AFP = atlas frontal plane; ACD = CSL = cervical spine line
#Calculation explained in Appendix 3
TNPI = trigeminal neuralgia pain intensity

CLINICAL FINDINGS AND ASSESSMENT

All participants underwent similar initial consultation and physical, orthopedic, and neurological examination with the first author. This enabled establishment of their condition and determination as to whether they met entry criteria for the study. This criterion included a diagnosis of chronic trigeminal neuralgia from medical physicians; unresolved trigeminal neuralgia despite various interventions including medication, massage, and/or surgery; and assessment using Atlas Orthogonal protocols to determine the presence and character of atlas subluxation.

The Atlas Orthogonal subluxation diagnostic protocols, which were carried out immediately before and after each adjustment, were as follows:

1. Static palpation to check for the presence of heightened tension and pain in the soft tissues of the upper cervical spine (Appendix 4). Results were graded in intensity from 0 (normal palpable compliance, no pain elicited) through 1 (mild pain), 2 (moderate pain) to 3 (severe pain, the participant winces in pain or "jumps" in response to the same palpatory pressure).
2. Visual observation to check for the presence of postural leg length inequality. This was detected with the participant lying supine on an examination table and measured by the difference in millimeters at the junctions of the shoe heels and heel counters (Appendix 5). In the case of bare feet, the adjacent internal malleoli of the ankles were compared.

In addition, before the first adjustment, the following were carried out:

3. Participants underwent X-ray examination to examine for osseous pathological conditions, fractures, or malformations and to determine structural/postural alignment of the cranio-cervical junction. This involved sagittal, frontal, and horizontal views of the upper cervical spine (Appendix 6).
4. The atlas plane line, the frontal cephalic line, and the cervical spine line were then drawn onto these radiographs and roentgenometric values of orthogonality calculated from them. These lines can be seen in Fig. 1 and on the pre- and post-adjustment radiographs of Case 3 in Figs. 2 and 3 respectively. Adjusting vectors were then calculated. (Appendix 7)

Table 2. Details of lines drawn on radiographs to establish roentgenometric values

Name of line	Used to determine (in degrees)
Atlas plane line	Deviation of atlas from horizontal
Frontal cephalic line	Deviation of head from vertical
Cervical spine line	Deviation of cervical spine from vertical

Fig. 3. Lines drawn on pre-adjustment radiographs for calculation of roentgenometric values

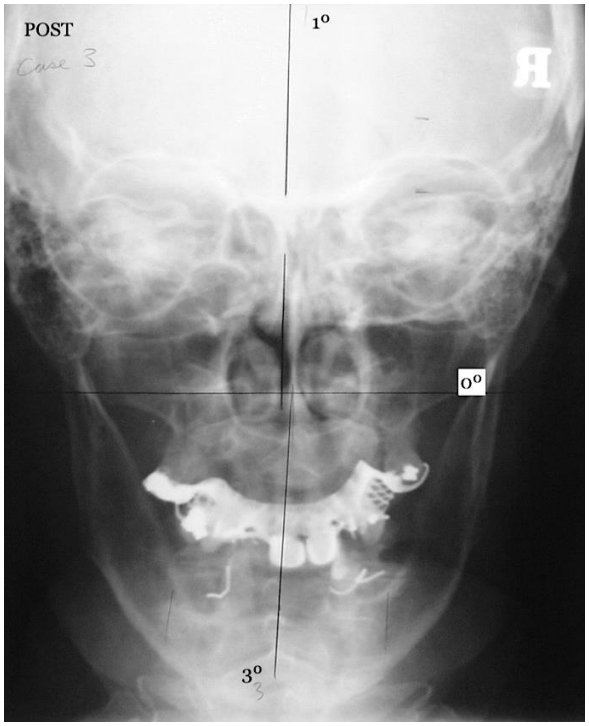

Fig. 4. Lines drawn on post-adjustment radiograph for calculation of roentgenometric values

Immediately before each adjustment, participants were also asked to indicate their current trigeminal neuralgia pain intensity level between zero (no pain) and ten (worst pain) on a

mechanical ruler visual analogue scale. The visual analog scale is a validated device commonly used in patient uni-dimensional self-reporting of acute or chronic pain intensity associated with many different conditions.[47] It was selected for use as an outcome measure in this study as it is inexpensive, requires no training, and is easy to use.[48] Participants were also asked to indicate their worst trigeminal neuralgia pain intensity level ever (before the first adjustment) or since the previous adjustment.

INTERVENTION

The five participants reported on in this present study met the criteria for Atlas Orthogonal intervention. Accordingly, the atlas vertebra of each was adjusted using the Atlas Orthogonal adjusting instrument.[4] The contact on the skin of the upper cervical spine was at a point between the mandible and mastoid process, just under the tragus notch of the lower ear. No other parts of the spine or body were adjusted.

Most participants were checked and adjusted (when indicated) twice a week for up to eight weeks. The exceptions were Participant 2, who was adjusted 9 times in four and a half weeks before discontinuing care for personal reasons, and Participant 5, who needed only nine adjustments during the eight-week period.

FOLLOW UP AND OUTCOMES

To discern any post-adjustment changes, steps 1 and 2 of the Atlas Orthogonal protocols were repeated immediately before and after each adjustment. In addition, Steps 3 and 4 were repeated immediately after the first adjustment.to discern any changes in roentgenometric values. No participants reported adverse or unanticipated events. visual analog scale recordings were also reported and recorded each visit before adjustment took place. Outcomes for each case are reported briefly in Table 1.

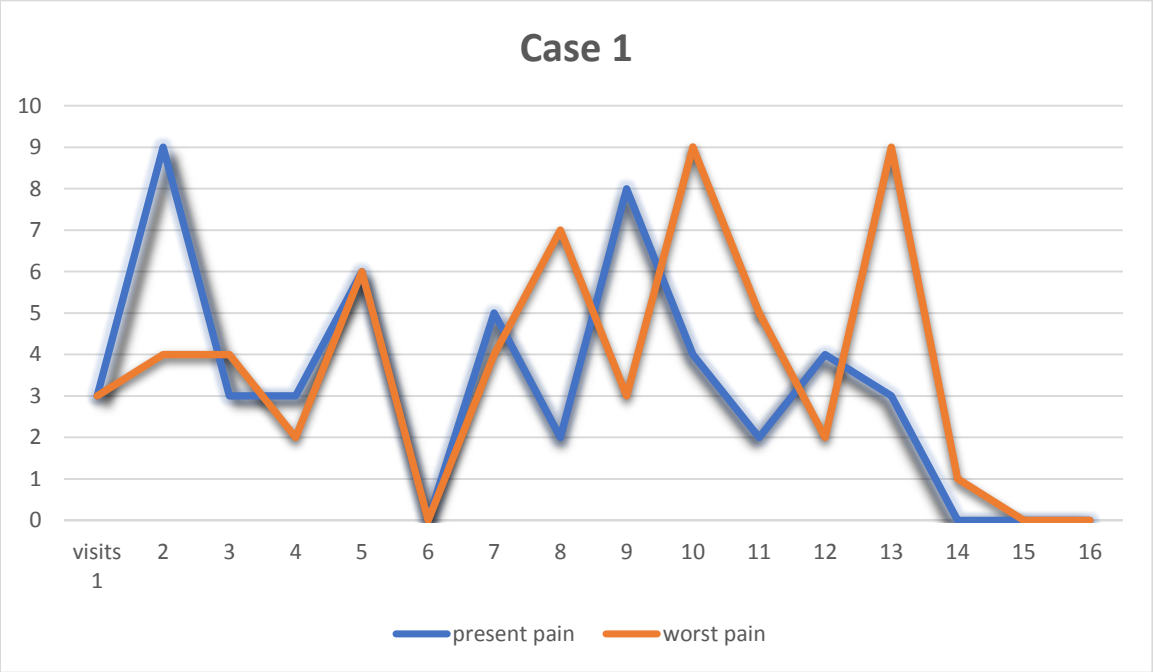

Fig. 4: Case 1 visual analog scale reports

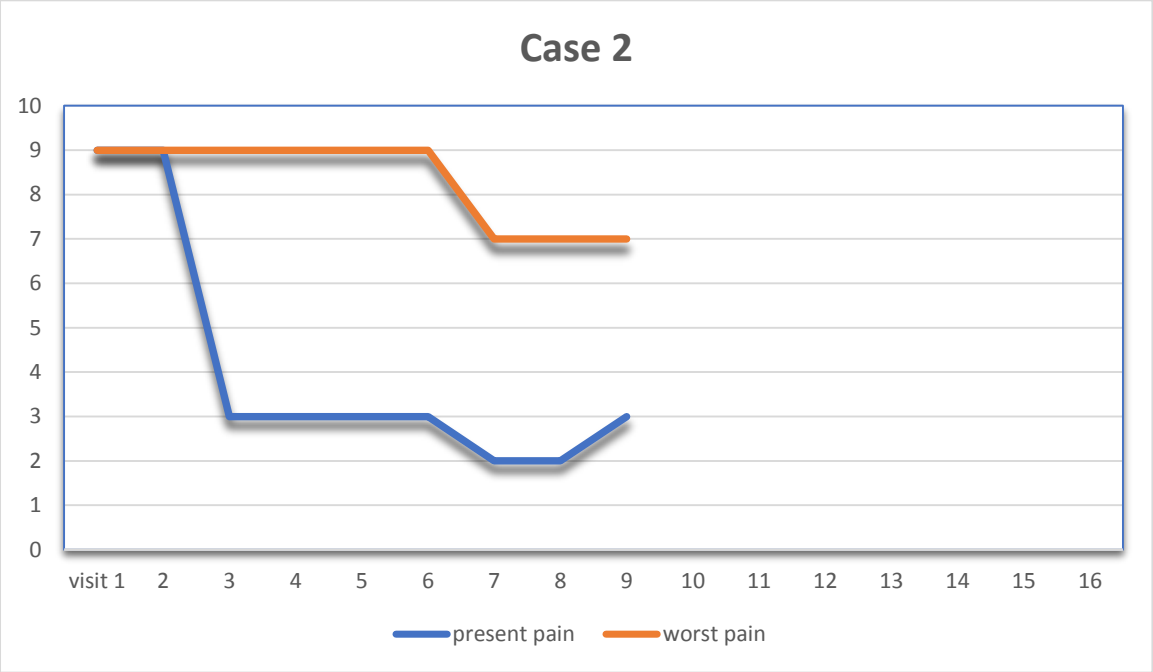

Fig. 5: Case 2 visual analog scale reports

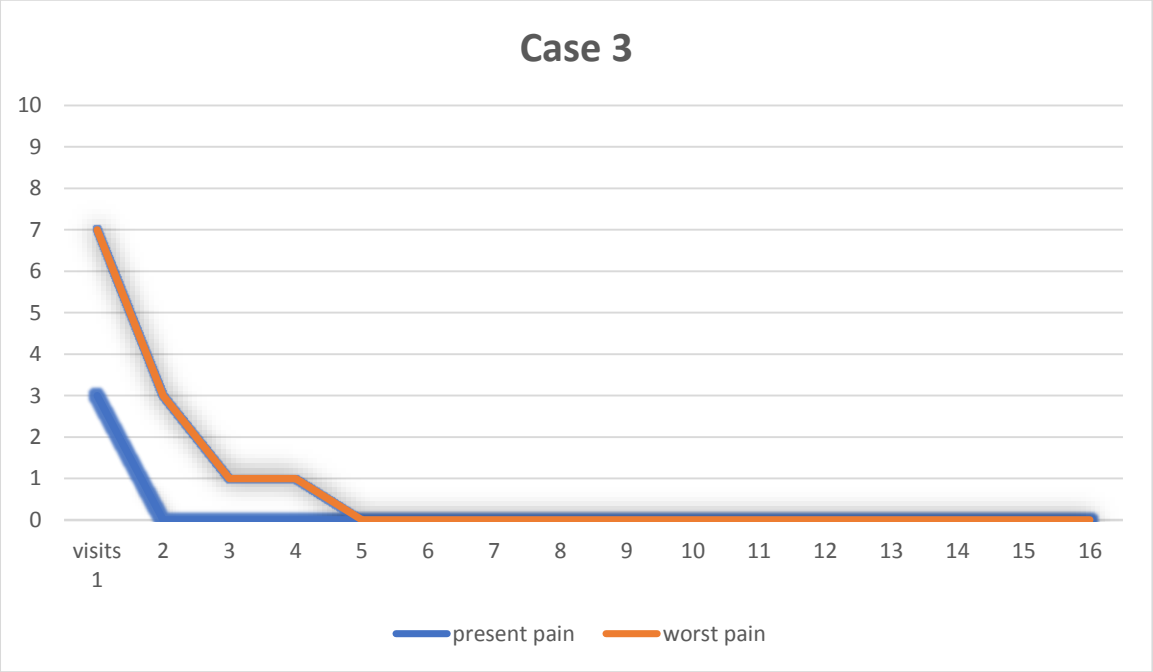

Fig. 6: Case 3 visual analog scale recordings

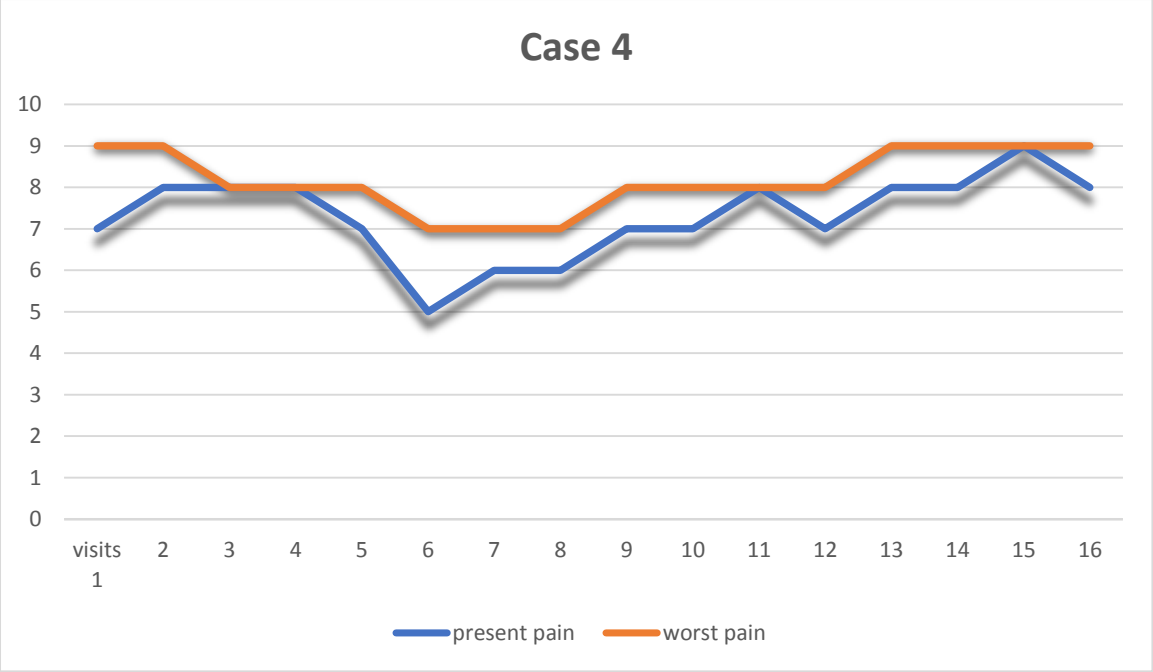

Fig. 7: Case 4 visual analog scale recordings

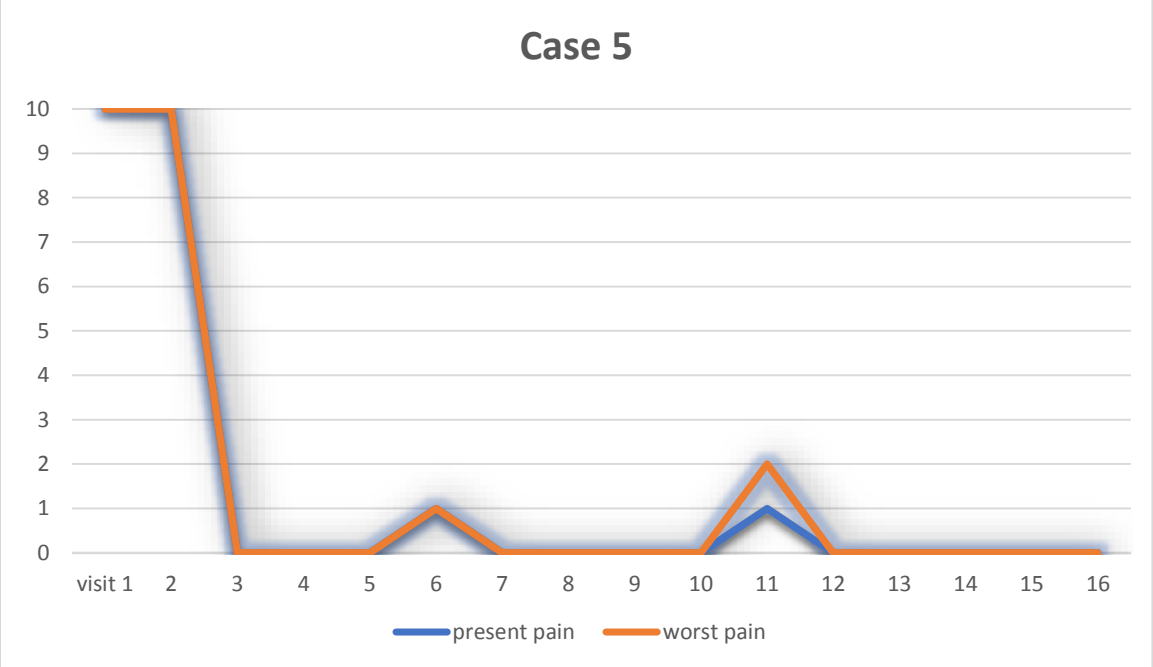

Fig. 8: Case 5 visual analog scale recordings

DISCUSSION

A body of literature addresses the upper cervical chiropractic subluxation and chiropractors' work with it,[28,39,40,43-45,49-61] including using Atlas Orthogonal technique.[61-66] In addition, two case reports describe the use of Atlas Orthogonal care in cases of trigeminal neuralgia. One reported on a 54-year-old male with a five-year history of alternating approximately six-month-

long periods of trigeminal neuralgia pain and three-month periods of remission.[32] The current period of pain was seven months long. He reported reduction of pain after one adjustment and the disappearance of pain after two more adjustments spread over seven visits in one month. He ceased taking carbamazepine and remained pain free after three months. The other case reported the disappearance of the trigeminal neuralgia symptoms of a 30-year-old female in 10 visits involving six adjustments over 39 days.[42] During some visits the chiropractor involved also applied an electromechanical percussion massage instrument to trigger points in neck and back muscles. However, these case reports typify the literature addressing upper cervical chiropractic care, which is composed mainly of clinical observations and case reports. In addition, not all of these articles appear in indexed and peer-reviewed journals.[40]

Congruent with repeated calls made in this upper cervical literature for further research, this present case series report extends the literature concerning upper cervical subluxation and chiropractic, particularly Atlas Orthogonal technique. The case series is a descriptive research design which follows and reports on a small group of participants who share a diagnosis and/or are receiving the same intervention over a similar period of time.[67]

As with most research designs, the case series has its own particular strengths and limitations.[68] In terms of strengths, this design has been suitable for the resent study to report on the effectiveness of an innovative intervention (Atlas Orthogonal technique) used by one chiropractor to address an unusual condition (trigeminal neuralgia) in a real-life clinical situation. The application of this intervention to five participants lessens the risks associated with a single case study,[69] such as practitioner and participant bias, variations in participant perceptions of pain, and the likelihood of cause-and-effect relationships being random.

On the other hand, the case series design also has limitations. For example, it has been criticized for lack of rigor. The present study's entry criteria involved no randomization and no effort at representation of the broader community, gender balance, or ethnic considerations. Indeed, the cases in this study may have been unusual in that they sought little-known Atlas Orthogonal chiropractic care. In addition, the lead author was the practitioner involved and may exhibit bias. While a case series can offer clues about causation,[70] firm inferences or generalizations about the effect of an intervention cannot be derived.[67,68] Nonetheless, when higher quality evidence does not exist, the case series can build on existing knowledge[71] and provide guidance in practice[72] and future research.[67] To maximize its rigor and value, a case series study should have a clearly described research question, group of participants, interventions, validated outcome measures, and results.[70] This present study sought to meet these criteria.

In addition, a limited amount of published literature examines some procedures used in Atlas Orthogonal technique. For example, one study showed good reliability in ascertaining the presence of leg length inequality and moderate reliability in quantifying it using the supine leg length test.[73] In addition, while roentgenometric procedures such as the basilar angle and McGregor's line are widely used,[74,75] there is some largely dated data which support the use of similar procedures by chiropractors in the characterization of the upper cervical subluxation by, for example, line drawing on x-ray.[40] More updated research on the validity or otherwise of these procedures is needed to justify their use, including the radiation dose received.

Four of the five cases in this present study reported reduction or disappearance of trigeminal neuralgia after Atlas Orthogonal intervention. While it is possible that these changes may have involved a placebo effect,[76] it should be remembered that one selection criteria for this study was that all participants had experienced long-term trigeminal neuralgia despite undergoing

commonly used interventions against it. From a chiropractic perspective, it could be argued that the Atlas Orthogonal adjustments may have corrected subluxations which were causing interference to areas of the nervous system which were involved in the participants' trigeminal neuralgia. Several hypotheses seek to explain how upper cervical adjustments might lead to the lessening or disappearance of trigeminal neuralgia pain.

One hypothesis relates specifically to the location, structure, and function of the spinal trigeminal nucleus. This hypothesis is based on the somatotrophic correspondence between the location of the facial trigger zone of trigeminal neuralgia patients and the location of the area affected by the pars oralis, the most caudal sub-nucleus of the spinal trigeminal nucleus.[4,77] The three extracranial branches (ophthalmic, maxillary, and mandibular) of the trigeminal nerve carry sensory information from the face into the intracranial trigeminal ganglion.[13] Their fibers then travel to the mesencephalic, motor, principal sensory, and spinal trigeminal nuclei in the brainstem. The main function of the spinal trigeminal nucleus is to process and project sensations of touch, temperature, and pain from the orofacial areas onwards to the thalamus and the cortex.[8] The spinal trigeminal nucleus is located in the lateral medulla with its nociceptive fibers located most laterally.[4] It extends caudally out of the skull down to the level of the third or fourth cervical vertebrae, where it gradually merges with spinal cord dorsal horn neurons.[4,8,13] Thus part of the spinal trigeminal nucleus is located within the cord within the spinal canal formed by the internal ring of the atlas.

It has therefore been hypothesized that atlas subluxation could place mechanical stress on the spinal trigeminal nucleus, causing it to be hyperactive and to initiate trigeminal neuralgia. However, the relative diameters of the spinal canal and the spinal cord mean that substantially larger displacements of the atlas than are commonly found in subluxation would be required to place such stress on the cord. This issue has been addressed by the dentate ligament – cord distortion hypothesis, which poses an anatomical explanation of how upper cervical spine misalignments might cause distortion of the cord.[78]

It is generally considered that the dentate ligaments support and stabilize the cord within the spinal canal.[79] These ligaments, also known as denticulate ligaments, are narrow fibrous bands located bilaterally at each vertebral level within the cervical and thoracic canal. Each triangular-shaped ligament has a small broad base fused to the long axis of the pia mater covering the cord and is located between the ventral and dorsal roots of the spinal nerves exiting the cord. The apex at the other end of each ligament attaches by a 3-5 mm fibrous band to the dura mater, which also ensheaths the spinal nerves as they leave the canal. Reflecting the greater mobility of the cervical spine, the ligaments there are thicker and sometimes penetrate into the cord to create a stronger attachment.[80] Outside of the dura the anterior and posterior internal vertebral venous plexuses cross the narrow connective and adipose tissue-filled epidural space between the dura and the vertebral periosteum which makes up the outer walls of the canal. The dura within the canal does not attach to the vertebral periosteum.

In contrast, the situation in the upper cervical region is different. Within the cranium the dura has an extra layer which attaches to the periosteum of the inner skull. This periosteal layer is firmly attached to the rim of the foramen magnum of the occiput medial to the bilateral atlanto-occipital articulations.[79] The base of the first (or intracranial) dentate ligament is larger than those of the other dentate ligaments and its apex extends superior-ward to also attach to the foramen magnum medial to the atlanto-occipital articulations. There is therefore a close structural relationship between these articulations, the first dentate ligament, and the trigeminal neuralgia. The dentate – cord hypothesis therefore posits that atlas subluxation may cause

traction on the ligament, mechanical deformation and irritation of the trigeminal neuralgia, particularly its lateral-most nociceptive part,[4] and sudden neuronal discharges perceived as trigeminal neuralgia.[43,78]

It has also been hypothesized that atlas misalignment could decrease blood flow in the vertebral arteries,[78] which are intimately physically associated with the atlas, and which contribute to the blood supply of the brain stem, pons, and trigeminal nerve.[42]Indeed the trigeminovascular system has been described as at the interface of the nervous and vascular systems.[5] Disruption of blood flow through, for example, arteries such as the posterior inferior cerebellar or vertebral artery could interfere with the processing of sensory information from the trigeminal nerve.[8] Such decreased blood supply may lead to ischemia and trigeminal neuralgia-associated hyperactivity in the nerve and trigeminal neuralgia. The Atlas Orthogonal adjustment of atlas may contribute to increased blood supply, decreased ischemia, and reduction of trigeminal neuralgia symptoms consequent to compression of the trigeminal nerve.

CONCLUSION

This case series reports on the application of Atlas Orthogonal upper cervical chiropractic care to five participants with chronic, severe, daily trigeminal neuralgia. Two reported complete cessation of the trigeminal neuralgia. Another two reported reduction in trigeminal neuralgia. Three participants reducing medication dosages. One reported no change in trigeminal neuralgia but lessening of non-trigeminal neuralgia symptoms. No participant reported adverse events. These outcomes should be comparted with those of medical and surgical interventions with trigeminal neuralgia sufferers. This article builds on pervious case reports and given the human toll of trigeminal neuralgia, sets the stage for much needed further research on chiropractic and trigeminal neuralgia.

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