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The Wide-Angle Lens: Transforaminal Ligaments, Unanswered questions

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Narrative: Not all humans have transforaminal ligaments (TFLs), and when present, they may be found at some levels and not others. Given that the TFL is a feature of human anatomy, why is it so variable?

Is it possible that TFLs form in response to postural or traumatic biomechanical stresses? Support for this hypothesis would include a statistically significant difference in the presence and distribution of TFLs between populations of people differing in age, occupation, or history of accident.

If the TFL is richly endowed with such sensory structures, the ligament would in effect be a monitor of changes in IVF dimensions. TFLs frequently cross the IVF in an oblique direction. This orientation would give mechanoreceptors the ability to monitor changes in vertical and horizontal IVF dimensions.

I recommend further inquiry into the clinical relevance of the TFL.

Indexing terms: Chiropractic; transforaminal ligament; TFL; comparative anatomy.

Introduction

The presence of ligaments that cross the intervertebral foramen (IVF) was first noted in a 19th Century publication. (Bougery, 1832) A detailed description of these ligaments was published 137 years later. (Golub and Silverman, 1969) Up to that point, dissection was the only way to study the transforaminal ligaments (TFL), which do not appear on x-ray imaging. Computerised tomography (CT) was not used in a clinical setting until 1971.

> *… research into the TFL offers a valuable area of study at the interface of basic and applied science …'*

Despite the fact that the TFLs have long been known to science and are identifiable on CT or magnetic resonance imaging (MRI), they are still little understood and often unreported in the clinical setting. As late as 2002, board certified radiologists missed TFLs more than 50% of the time, even though these ligaments were visible on MRI. (Cramer et al, 2002)

Today, there remain many unanswered questions surrounding the TFLs. In fact, the term itself raises questions of definition. By convention, a ligament joins two bones. The typical TFL has points of attachment at two different sites of the same vertebra. Other questions go beyond mere issues of classification. Some humans have TFLs, and some do not. Also, those who do have TFLs do not usually have them at all spinal levels. Why is this? Other questions have to do with clinical significance, tissue development, and evolutionary factors.

Are Transforaminal Ligaments clinically significant?

Imagine having your head out of a car window as it is driven over a bumpy road. As hazardous as this situation is for your neck, it becomes much more hazardous if the window is partially closed. By analogy, the presence of TFLs would seem to partially close the foraminal 'window', potentially causing spinal compression or distraction to be more irritating to the spinal nerve roots than would otherwise be the case. It seems to make intuitive sense that TFLs increase the hazard to the human spine as it travels over the 'bumpy road' of life.

However, there is little or no evidence to support the concept of TFLs as hazards. In fact, the opposite has been proposed. Some investigators suggest that the neurovascular structures within the IVF are supported and protected by the TFLs; (Umeh et al 2016; Yuan et al, 2015)

> Is there a statistically significant difference in the occurrence of neuritis at spinal levels with TFLs versus levels without TFLs? Such data would help resolve the questions of clinical significance and perhaps raise deeper questions.

If the TFLs are in fact protective, do they continue to serve this function in the face of traumatic history or age-related degenerative change? Do clinical interventions intended to cause beneficial changes in the IVF sometimes go wrong due to poor understanding of TFL mechanics?

In this regard, it is interesting to note that spinal traction, a modality often used to relieve spinal neuropathy by decompressing the IVF, sometimes worsens the signs and symptoms of spinal neuropathy. In a 2013 review of spinal traction, adverse effects were reported in seven out of 32 studies. (Wegner et al, 2013) These adverse effects included increased pain, exacerbation of neurological signs, and in some cases subsequent surgery. Is the presence of TFLs at the targeted spinal levels a risk factor for such adverse events?

Why is the presence of TFLs irregular?

As previously noted, not all humans have TFLs, and when present, they may be found at some levels and not others. Given that the TFL is a feature of human anatomy, why is it so variable?

Is it possible that TFLs form in response to postural or traumatic biomechanical stresses? Support for this hypothesis would include a statistically significant difference in the presence and distribution of TFLs between populations of people differing in age, occupation, or history of accident.

At least one set of ligaments is known to form in response to postural development. The iliolumbar ligament is absent at birth and does not develop until around the time of puberty, a time of biomechanical as well as hormonal change. (Jiang et al, 1995) Perhaps the TFL is likewise a physiological response to biomechanical change. With this in mind, the distribution of TFLs in adolescent idiopathic scoliosis could be a rewarding area for study.

Are mechanoreceptors present in TFLs? If yes, are TFLs densely or sparsely populated with mechanoreceptors compared to other ligaments of similar size?

If the TFL is richly endowed with such sensory structures, the ligament would in effect be a monitor of changes in IVF dimensions. TFLs frequently cross the IVF in an oblique direction. This orientation would give mechanoreceptors the ability to monitor changes in vertical and horizontal IVF dimensions. Potentially, such sensory equipment within the IVF could give the

nervous system early warnings of threats to IVF integrity from such events as compression fractures, spondylolisthesis, disc degeneration, progression of scoliosis, and subluxation. If this is the case, does this sensory information enhance the body's response to IVF change in some way?

What is the evolutionary significance of TFLs?

What sorts of animals possess structures similar to the human TFL? What insight does that offer regarding the significance of these ligaments in humans?

There are some data available on this question already. A 1995 study comparing the presence of spinal ligaments in bipeds vs quadrupeds found midline spinal ligaments (anterior and posterior) in all animals studied. (Jiang et al 1995) Although TFLs were not addressed as such, the authors note that lateral ligaments, presumably including TFLs, are found in humans and birds, but not quadrupeds. This tends to support the previously mentioned possibility that TFLs are a feature of postural development.

Does the development of TFLs in a vertebrate depend on what levels of the spine bear the greatest amount of mechanical stress? This seems to be the case with humans, in whom TFLs are most commonly found in the lumbar spine. Does a long-necked animal such as a giraffe, a swan, or an ostrich have a higher frequency of TFLs in the cervical and upper thoracic spine?

How early in evolutionary terms did the TFLs develop? Can traces of TFLs be found in the fossilised spines of bipedal dinosaurs, for example? I put this question to Dr Hans Sues of the Natural History Museum at the Smithsonian Institution. He replied:

> 'My search of the literature has unfortunately found no mentioning of transforaminal ligaments in non-avian dinosaurs. There are various papers on the ligamentous systems associated primarily with the epaxial musculature. The interspinal ligaments often leave prominent points of attachment, for example, the neural spines on tyrannosauroid vertebrae have prominent anterior (cranial) and posterior (caudal) rugosities. It is possible that any transforaminal ligaments left no osteological landmarks'. (Sues, 2025)

Of course, given the variable presence of TFLs in modern humans, it is possible that their presence was also variable in the deep past. Perhaps some bipedal dinosaurs had them, and some did not. A second look focused on that possibility could be interesting.

Conclusion

The importance of IVF dynamics in clinical work in general and Chiropractic care in particular suggests that research into the TFL offers a valuable area of study at the interface of basic and applied science. The questions raised in this paper will hopefully contribute to this effort.

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References

Akdemir G. Thoracic and lumbar intraforaminal ligaments. J Neurosurg Spine. 2010 Sep;13(3):351-5. Thoracic and lumbar intraforaminal ligaments - PubMed

Bougery JM. Traite complet de l' Homme. In Bougery JM (ed). Comprenant la Medicine Operatoir. C. Delauney; Paris, 1832, pp 449-50.

Cramer GD, Skogsbergh DR, Bakkum BW, Winterstein JF, Yu SW, Tuck NR. Evaluation of Transforaminal Ligaments by Magnetic Resonance Imaging. J Manipulative Physiol Ther, 2002; 25: 199-208. Evaluation of transforaminal ligaments by magnetic resonance imaging - PubMed

Golub BS, Silverman B. Transforaminal ligaments of the lumbar spine. J Bone Joint Surg Am. 1969 Jul;51(5):947-56.

Jiang H, Moreau M, Raso VJ, Russell G, Bagnall K. A comparison of spinal ligaments--differences between bipeds and quadrupeds. J Anat. 1995 Aug;187 (Pt 1)(Pt 1):85-91. A comparison of spinal ligaments--differences between bipeds and quadrupeds - PubMed

Qian Y, Qin A, Zheng MH. Transforaminal ligament may play a role in lumbar nerve root compression of foraminal stenosis. Med Hypotheses. 2011 Dec;77(6):1148-9. Transforaminal ligament may play a role in lumbar nerve root compression of foraminal stenosis - PubMed

Schulz RA, Stein JA, Pelc NJ. How CT happened: the early development of medical computed tomography. J Med Imaging (Bellingham). 2021 Sep;8(5):052110. How CT happened: the early development of medical computed tomography - PubMed

Sues H. Email reply; June 13, 2025.

Umeh R, Fisahn C, Burgess B, Iwanaga J, Moisi M, Oskouian RJ, Tubbs RS. Transforaminal Ligaments of the Lumbar Spine: A Comprehensive Review. Cureus. 2016 Oct 2;8(10):e811. Full text: https://pmc.ncbi.nlm.nih.gov/articles/PMC6706257/pdf/cureus-0008-00000000811.pdf

Wegner I, Widyahening IS, van Tulder MW, et al. Traction for low-back pain with or without sciatica. Cochrane Database Syst Rev. 2013 Aug 19;2013(8):CD003010. Traction for low-back pain with or without sciatica - PubMed

Yuan, Sg., Wen, Yl., Zhang, P. et al. Ligament, nerve, and blood vessel anatomy of the lateral zone of the lumbar intervertebral foramina. International Orthopaedics (SJICOT) 39, 2135–2141 (2015). Ligament, nerve, and blood vessel anatomy of the lateral zone of the lumbar intervertebral foramina - PubMed

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Dr Masarsky also writes a frequent feature in the *Journal* called '*The Wide Angle Lens*' in which he takes a broader than usual perspective on one issue or another, and has contributed much on clinical aspects of COVID.

Also by this author

Masarsky CS. Hypothesis: Chiropractic adjustments reduce the risk of stroke in Long COVID. Asia-Pac Chiropr J. 2025;6.1. www.apcj.net/papers-issue-6-1/#MasarskyLongCOVIDHypothesis

Masarsky CS, Todres-Masarsky M. Long COVID with Obstructive Sleep Apnea: A case report. Asia-Pac Chiropr J. 2025;6.1. www.apcj.net/papers-issue-6-1/#MasarskySleepApnea

Masarsky CS. Respiratory RCTs: What Are We Missing? [The wide-angle lens]. Asia-Pac Chiropr J. 2025;5.3. www.apcj.net/papers-issue-5-3/#MasarskyRespiratoryRCTs

Masarsky CS, Todres-Masarsky M. Long COVID with Parosmia and Exertional Malaise: A case report. Asia-Pac Chiropr J. 2025;5.4. www.apcj.net/papers-issue-5-4/#MasarskyLongCOVID

Masarsky CS, Todres-Masarsky M. Long Haul COVID-19 and Subluxation: A case report. Asia-Pac Chiropr J. 2022;2.6. apcj.net/papers-issue-2-6/#MasarskyLongCovid
.
Masarsky CS, Todres-Masarsky M. Long COVID Hyposmia/Parosmia and subluxation: A case report. Asia-Pac Chiropr J. 2022;3.2. apcj.net/Papers-Issue-3-2/#MasarskyHyposmia.

Masarsky CS, Todres-Masarsky M. Long COVID: A Risk Factor for Scoliosis Incidence and Exacerbation? [Hypothesis] Asia-Pac Chiropr J. 2023;3.3. apcj.net/Papers-Issue-3-3/#MasarskyLongCovidScoliosis.

Masarsky CS, Todres-Masarsky M. Long COVID Pharyngitis, Possible Glossopharyngeal Neuralgia, and Subluxation: A case report URL Asia-Pac Chiropr J. 2023;4.1. apcj.net/Papers-Issue-4-1#MasarskyTodreaMasarskyLongCovid

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