Winter / Spring 2022

FOUR LEG NEWS

THE TRACTION EDITION

TO TRACTION OR NOT TO TRACTION… THAT DISC!

Based on a recent discussion about whether we should be performing traction on dogs with discogenic lesion or not… this literature search ensued!

Hi Everyone!
Firstly, I've reduced the Four Leg News output to twice a year. They take a lot of work, and I've been told that you guys like videos better anyways. However, this is a timely topic and it works as a newsletter! I have been using traction for almost 3 decades. I think it works. I've never seen an adverse event. I've been teaching others how to do it for over 2 decades. It makes sense. So, to understand the mechanics of why traction works (in both human and animal studies), I've done a literature search for you guys to learn from and use to promote its use in clinical practice! Enjoy!

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Human Studies

What are the Mechanical Effects of Traction on the Intervertebral Discs?

Chow DHK, Yuen EMK, Xiao L, Leung MCP. **Mechanical effects of traction on lumbar intervertebral discs: A magnetic resonance imaging study**. Musculoskelet Sci Pract. 2017 Jun;29:78-83.

What and Why?
The study looked at the mechanisms of traction and the mechanical effects. Essentially, DOES separation of the vertebra occur with traction?

What did they do?
The researchers took 9 healthy college students. They performed MRI's on their lumbar spines at the beginning of the study, then again after 30 minutes of horizontal rest, and then again after 30 minutes of mechanical traction. Traction consisted of continuous traction at 42% of body weight.

Results:
Traction resulted in significant increases in disc height in all lumbar discs – from pre-rest to post-traction. There were no significant changes in disc height with rest alone. Between the post-rest average disc height measurements and the post-traction average disc height measurement, those with significant differences were L3-4, L4-5, and L5-S1. There were differences noted in anterior disc height, central disc height and posterior disc height. (Figure 1)

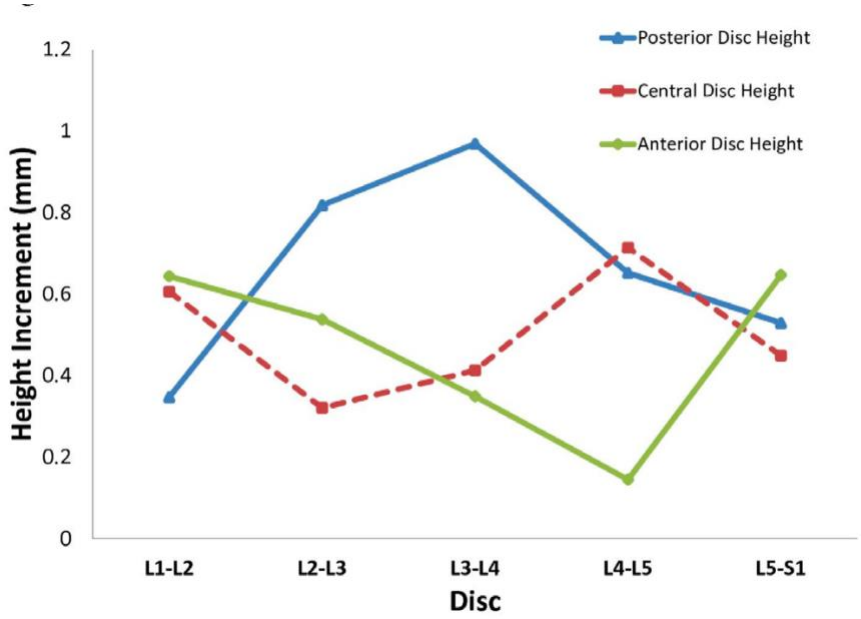


Figure 1: Changes in posterior, central, and anterior disc heights among different discs.

Discussion worth mentioning:
"As disc changes appear more pronounced with traction equalling 44-50% of body weight than that equalling 10-19% (van de Heijden et al., 1995; Sari et al., 2003; Ozturk et al., 2006; Santos and Riberior, 2011; Chung et al., 2015) and significant increase in disc heights was found in low back pain patients with the application of average maximum and tolerable traction forces between 42-65% of body weight (Apfel et al., 2010), the lowest threshold equivalent to 42% of participant's body weight of these studies in both healthy and low back pain patients was chosen as a horizontal continuous traction force in this study."

More About Increasing Disc Height

Apfel CC, Cakmakkaya OS, Martin W, Richmond C, Macario A, George E, Schaefer M, Pergolizzi JV. **Restoration of disk height through non-surgical spinal decompression is associated with decreased discogenic low back pain: a retrospective cohort study**. BMC Musculoskelet Disord. 2010 Jul 8;11:155.

In this retrospective study, 30 patients with low back pain attributed to disc herniation were treated with traction. Twenty two sessions were applied over a 6-week period consisting of 28-minutes of traction per session. Traction was administered starting at 10 lbs (4.54kgs) less than half their body weight and then increased as tolerated to a maximum of 10 – 20 lbs more than half of their body weight.

Disc height was measured via CT scan before starting the treatment session and the day of or day after the last day of treatment.

Results? Disc heights increased significantly and pain scored decreased significantly. There was a statistically significant correlation between the increase in disc height and a reduction in pain ($r = 0.36$, $p = 0.044$), with a 1 mm increase in disc height being associated with a reduction of 1.86 on the 11-point verbal rating scale (Fig. 3). No adverse events were reported during the treatment period.

Disc Height Continued

Karimi N, Akbarov P, Rahnama L. **Effects of segmental traction therapy on lumbar disc herniation in patients with acute low back pain measured by magnetic resonance imaging: A single arm clinical trial.** J Back Musculoskelet Rehabil. 2017;30(2):247-253.

Here, 15 patients with low back pain attributable to lumbar disc hernaition undertook 15 sessions of traction (5 days a week for 3 weeks). Each patient received an MRI before and after the treatment protocol.

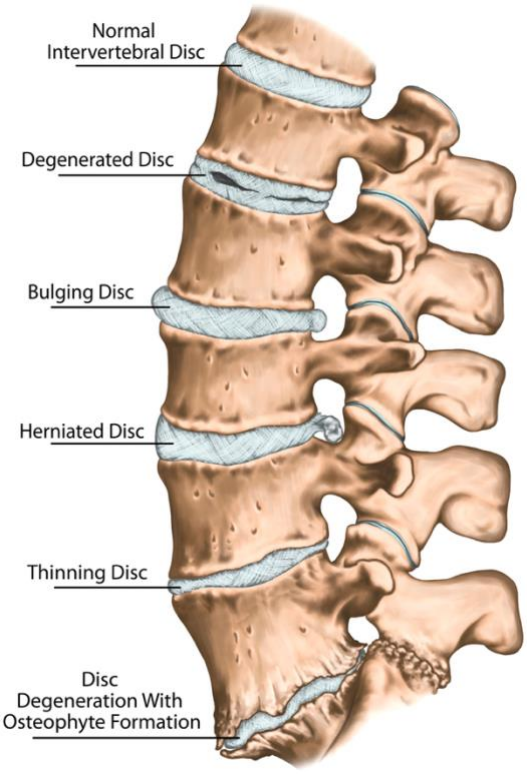
MRI examination indicated a significant reduction in herniated mass size. A significant pain reduction was observed after the treatment protocol. Lumbar flexion ROM also showed a significant improvement.

And Even More Disc Height Research

Liu ZZ, Wen HQ, Zhu YQ, Zhao BL, Kong QC, Chen JY, Guo RM. **Short-Term Effect of Lumbar Traction on Intervertebral Discs in Patients with Low Back Pain: Correlation between the T2 Value and ODI/VAS Score.** Cartilage. 2021 Dec;13(1_suppl):414S-423S.

This study determined that traction resulted in a significant increase in measurements of the nucleus pulposus of the disc in 24 patients as compared to a control group of 24 patients who were told to rest, not stand, sit, or bend, or lift. MRI was used before and after the interventions to evaluate the results.

Traction intervention used a force of 40% body weight applied for 30-minute sessions, 2 – 3 times per week, for a total of 10 sessions.



Effects of Traction on Size of Herniated Disc Material

Ozturk B, Gunduz OH, Ozoran K, Bostanoglu S. **Effect of continuous lumbar traction on the size of herniated disc material in lumbar disc herniation**. Rheumatol Int. 2006 May;26(7):622-6.

This RCT of 46 patients with CT-verified herniated discs in the lumbar spine, were assigned to a control group or a traction group. Both groups also received treatments of hot packs, ultrasound, and interferential current therapies. Therapies were administered daily (5x/week) for 3-weeks for a total of 15 treatment sessions.

Fifteen-minutes of continuous traction was administered to the traction-group starting with 25% of patients' body weight, and increased with the same increment every day to 50% of the patients' body weight at the tenth session, and continued at this level to the end of the treatment.

A CT was performed before and after the interventions and herniated disc measurements were taken as per Figure 2. Additional testing included used of a Visual Analogue Scale (VAS), modified Schober test (to evaluate lumber ROM), and Straight Leg Raise (SLR) measurements, in addition to motor function testing, dermatome sensory testing, and reflex testing. Clinical examinations were performed before and after the treatment.

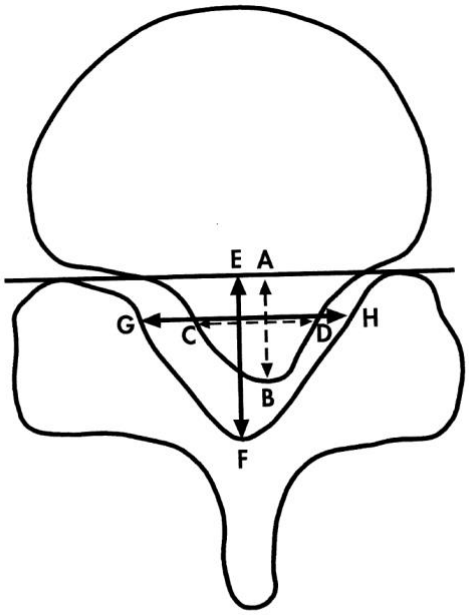


Fig. 2 Schematic diagram of the CT measurements. AB = maximum anteroposterior disc length, CD = width of the herniated material at the level of the mid AB distance, EF = maximum anteroposterior canal length, GH = width of the spinal canal at the level of the mid AB distance. The "herniation index" is calculated as: (AB × CD)/(EF × GH) × 1,000

Findings?

- VAS scores, motor function, and sensory function did not differ significantly between the two groups.
- For patients with sciatica, the SLR angle, and degree of motor loss (%) between before and after the treatment, the difference between the traction and control groups was statistically significant.
- In the traction group, while seven patients had diminished reflexes before the treatment, we observed full recovery in four and partial recovery in one patient after the treatment. In the control group, the number of patients with diminished reflexes was eight, and none of them had improvement. (Differences were statistically significant).
- When the CT findings were evaluated, there was a significant decrease in disc material extrusion between before and after treatment in the traction group.
- **In the traction group, there was a significant positive correlation between "the degree of improvement in CT" and the relative size of herniated disc.**

LET'S TAKE IT TO THE ANIMALS!

Ramos RM, da Costa RC, Oliveira AL, Kodigudla MK, Goel VK. **Morphological changes of the caudal cervical intervertebral foramina due to flexion-extension and compression-traction movements in the canine cervical vertebral column.** BMC Vet Res. 2015 Aug 6;11:184.

While this study was looking at changes in the intervertebral foramina with various movements and forces as it pertains to Wobber dogs, it can be useful for us to understand what happens with traction in the cervical spine in general.

If I jump to the conclusion first, I'll start with, "Flexion and traction forces increase the foraminal dimensions." See Figure 3.

This was a cadaver study. As such, it is hard to compare it to the other studies and isolate how much percentage body weight of traction was administered. Was it enough? Too much? And of course the study wasn't looking at clinical outcomes. So, all we can say is that traction can increase foraminal spaces.

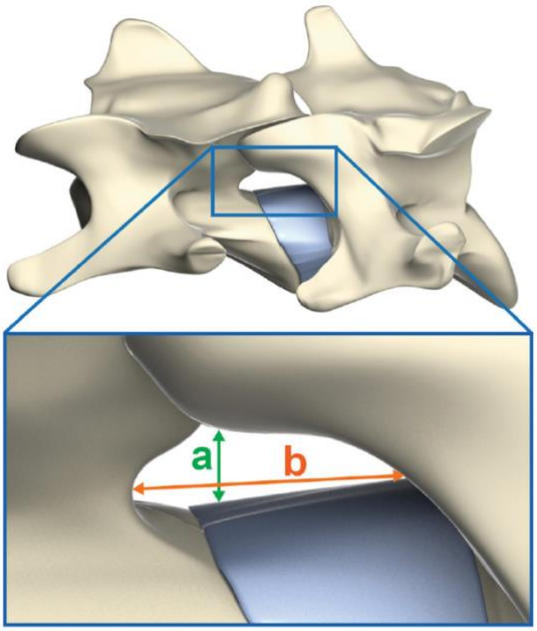


Fig. 3 Reference points to measure the dimensions of the cervical vertebral foramina of dogs. **a**, Measurement of foraminal height at C4-5, C5-6 and C6-7. **b**, Measurement of foraminal width at C4-5, C5-6 and C6-7

Rabbit Discs and Traction

Guehring T, Unglaub F, Lorenz H, Omlor G, Wilke HJ, Kroeber MW. **Intradiscal pressure measurements in normal discs, compressed discs and compressed discs treated with axial posterior disc distraction: an experimental study on the rabbit lumbar spine model**. Eur Spine J. 2006 May;15(5):597-604.

This is one of those 'sciency' studies that needs picking apart to full comprehend. However, that doesn't provide us with any additional useful tidbits beyond the discussion and summation statements provided in the paper itself.

In brief, this study took some rabbits and measured disc pressures with them lying prone. Then they compressed their discs with a device for 28 days, and measured disc pressures again. Then they distracted the discs for another 28 days and measured after that.

When compared to the normal disc state (in prone lying), compression reduced disc pressure. (As in the water content was squished out and the disc no longer had it's normal internal

pressure mechanism that makes the disc a shock absorber). After traction, the disc pressures increased as compared to the squished discs but were lower than the neutral / normal state. All in all, this study isn't at all representative of a clinical intervention.

Here's the summation statement:
"These data support the hypothesis that temporary external compression leads to moderate disc degeneration as a result of degradation of water-binding disc matrix or affected active pumping mechanisms of nutrients into the disc. A stabilization of IVD pressure in discs treated with temporary distraction was observed."

Can Traction Help Heal Degenerative Discs?

Kroeber M, Unglaub F, Guehring T, Nerlich A, Hadi T, Lotz J, Carstens C. **Effects of controlled dynamic disc distraction on degenerated intervertebral discs: an in vivo study on the rabbit lumbar spine model.** Spine (Phila Pa 1976). 2005 Jan 15;30(2):181-7. \

Another rabbit model and similar study to the one above. (See figure 4.) This time five groups were studied.
Group 1: Discs were loaded (compressed) for 28 days, then distracted for 7 days
Group 2: Discs were loaded for 28 days, then distracted for 28 days.
Group 3: Discs were distracted for 28 days (without prior loading).
Group 4: Discs were loaded for 28 days (without subsequent distraction).
Group 5: Was sham operated.

Results:
After 28 days, loaded discs had a decrease in disc space and histological disorganization of the anulus occurred, with a significant increase in the number of dead cells in the anulus and cartilage endplates. These changes were reversible with 28 days of distraction. Histologically, the discs showed signs of tissue regeneration after 28 days of distraction. The number of dead cells decreased significantly in comparison with the loaded discs without distraction.

Conclusion:
The results of this study suggest that disc regeneration can be induced by axial dynamic distraction in the rabbit intervertebral disc.

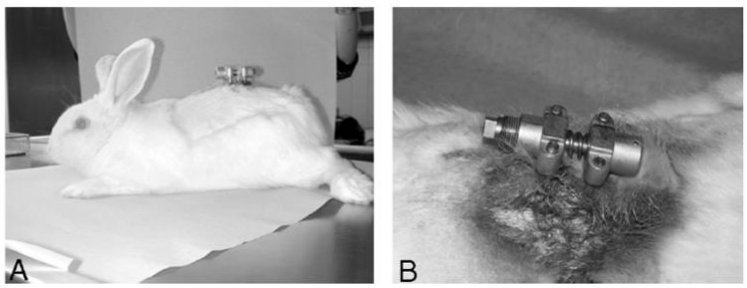


Figure 4 External dynamic distraction device attached to the rabbit lumbar spine.

A Tale of Rat Discs… Or Rather Discs in Rat Tails

Lai A, Chow DH. **Effects of traction on structural properties of degenerated disc using an in vivo rat-tail model.** Spine (Phila Pa 1976). 2010 Jun 15;35(14):1339-45.

Here we have an in-vivo rat tail model adopted to study the structural changes of degenerated intervertebral disc after different traction protocols.

The set up: Forty-seven mature rats were used. Continuous static compression of 11 N was applied to the rat caudal 8-9 disc for 2 weeks to simulate disc degeneration.

The intervention: Tractions with different modes (static or intermittent) and magnitudes (1.4 N or 4.2 N) were applied to the degenerated disc for 3 weeks. (Note, the intermittent traction consisted to 10 seconds loading, 10 seconds off-loading. The traction stresses were also estimated to be equivalent to human traction of 15% and 45% body weight, respectively.)
See Table 1 below.

Table 1. The Protocol and the No. Animals Completed the Whole Experimental Protocol for the 6 Experimental Groups

Groups	Experimental Protocol			No. Rats Completed the Experiment	No. Specimens for Histologic Analysis
	Day 1	Day 4–17	Day 18–38		
A Sham	Pin insertion	Rest	Rest	8	7
B Compression		Compression	Rest	7	7
C Static_1.4 N		Compression	Traction (static, 1.4 N)	8	8
D Static_4.2 N		Compression	Traction (static, 4.2 N)	8	8
E Intermittent_1.4 N		Compression	Traction (intermittent, 1.4 N)	8	8
F Intermittent_4.2 N		Compression	Traction (intermittent, 4.2 N)	8	7
			Total	47	45

Compression indicates continuous static compression of 11 N; Rest, no application of any external intervention.

The evaluation: The disc height was quantified in vivo on days 4, 18, and 39. The treated discs were then harvested for morphologic analysis.

Results

- As was the purpose of the 'set up', compression resulted in reduction in disc height and morphological degenerative changes.
- The disc height continued to decrease after traction of 4.2 N in the static and intermittent groups.
- the disc height almost maintained after traction of 1.4 N for both static and intermittent tractions.
- Traction did not have a significant effect on morphologic degenerative changes in the discs.

Conclusion:
Although traction was not demonstrated to have restored discs with degeneration, the results suggested that traction of low magnitude may be a potential intervention to slow down the process of degeneration.

Rat Tails: Degeneration, Inflammation, and Traction

Han C, Ma XL, Wang T, Ma JX, Tian P, Zang JC, Kong JB, Li XD**. Low magnitude of tensile stress represses the inflammatory response at intervertebral disc in rats**. J Orthop Surg Res. 2015 Feb 7;10:26.

This study is tricky to follow, at least for me. I'm going to stick with the bare bone basics.

Goal: This study aimed to determine if the involvement of tensile stress affects the expressions of inflammatory cytokines interleukin-17(IL-17), interleukin-1β (IL-1β), and inducible nitric oxide synthase (iNOS) at intervertebral discs in vivo.

What did they do?

They had four groups. One was a control group. One group received tail suspension. One group received a needle puncture to the disc. One group received a needle puncture to the disc and tail suspension.

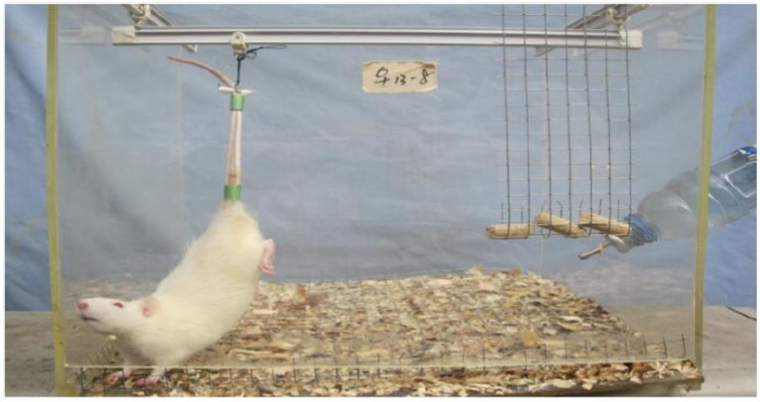


Figure 5 **The rat's hind limbs are off the cage floor.** The rat could move to every corner of the cage.

The needle puncture was used to create an inflammatory response. Tail suspension provided a low tensile stress on average of 2.45 N (which according to the authors reported calculations would account to be 100% body weight). They 'hung out' this way for 4 weeks.

Jumping to the Conclusion

It was demonstrated that mechanical strain with relatively low magnitude had a significant positive effect in the spinal disease by restraining the degree of inflammation. Although tensile stress was not able to reverse the process of disease in intervertebral disc, the results suggested that the tensile stress in low magnitude played a positive role in relieving the symptom of low back pain.

And This Little Piggy had Disc Degeneration

Kuo YW, Hsu YC, Chuang IT, Chao PH, Wang JL. **Spinal traction promotes molecular transportation in a simulated degenerative intervertebral disc model**. Spine (Phila Pa 1976). 2014 Apr 20;39(9):E550-6.

This study was in-vitro unfortunately, but it does provide us with additional information.

The Goal: To find the effect of traction treatment on annulus microstructure, molecular convection, and cell viability of degraded discs.

How?
48 thoracic discs were dissected from 8 porcine spines and divided into 3 groups: A control group, a group that was subjected to degradation of the disc, and a group that received traction after degradation of the disc.

Discs were degraded with 0.5 mL of trypsin on day 1 and a 5-hour fatigue loading on day 2.

From days 4 – 6, the group that was to receive traction received a 30-minute traction treatment per day (traction force: 20 kg; loading: unloading = 30 s: 10 s). (Note, this would be the equivalent of 14% body weight as per the reported weight of the pigs.)

Evaluation: By the end of the incubation, the discs were inspected for disc height loss, annulus microstructure, molecular (fluorescein sodium) intensity, and cell viability.

Results

- Collagen fibers are crimped and delaminated, whereas the pores are occluded in the anulus fibrosus of degraded discs.
- Disc height, molecular convection, and cell viability decrease in the degraded disc.
- With traction treatment, collagen fibers are straightened, and pores are less occluded in the anulus fibrosus (AF) of the degraded disc. Meanwhile, pores and cracks within the AF increase without disc height loss.
- Molecular convection and cell viability of the degraded disc increase with traction treatment, but not to the intact level.

Conclusion
With spinal traction, disc height is maintained and the debris in the pores of the anulus fibrosus are expelled. The nutrient transportation and cell viability are thus enhanced, hence relieving the degeneration process.

And CLINICALLY – What would traction look like in a dog?

1 Small Dog Cervical Traction

Reps: 3 - 5 Freq: 2 - 3 x / day Hold: 15 - 30 sec

Hold your pet in your arms with his/her head resting on the crook of your elbow. With your other hand place your thumb and a finger behind the skull and slowly push forwards on the head to create a traction. Go slow and stay within tolerance. Push and hold a comfortable amount of traction. Slowly release & repeat.

2 Toe touches - hip and back extension

Reps: 3 - 5 Freq: 2 - 3 x / day Hold: 15 - 30 sec

While standing, sitting, or kneeling behind your dog, grasp him/her under the chest. Slow lift the front end off the ground, allowing the hind feet to still touch the ground.

3 Traction - hanging traction

Sets: 1 Freq: 1 - 5x/ day Duration: 30 sec - 2 min

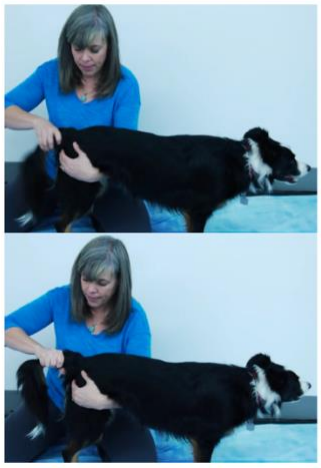
While standing, sitting, or kneeling behind your dog, grasp him/her under the chest. Slow lift the front end off the ground, and allowing the rear feet to also come off the ground.

4 Traction - Side lying neck traction

Reps: 5 or more Freq: 1 - 3x/day Hold: 10 - 30 seconds
Tempo: slow

With your dog in sidelying, place a thumb and finger behind his/her skull. Your other hand can rest under the chin. Slowly push forwards on the head to elongate the neck. Only push to where the dog is still comfortable (i.e. take up the slack in the neck muscles). Hold this push. Slowly release. Repeat.

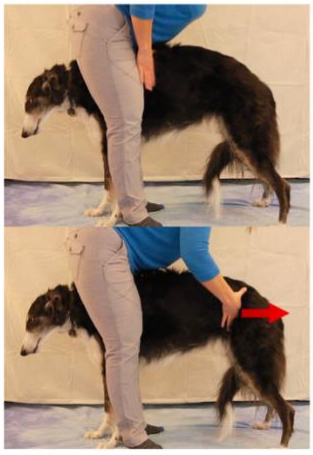
5 Traction - Tail pulls



Reps: 5-10 Freq: 2-3x/day or more often Hold: 15-20second

Start in standing or lying. Grasp the base of the tail with one hand and put you hand at the back of the pelvis with the other. Slowly pull the tail away from the body. Resist with your hand on the back of the pelvis. Hold the pull then slowly release.

6 Traction - Standing Back Traction



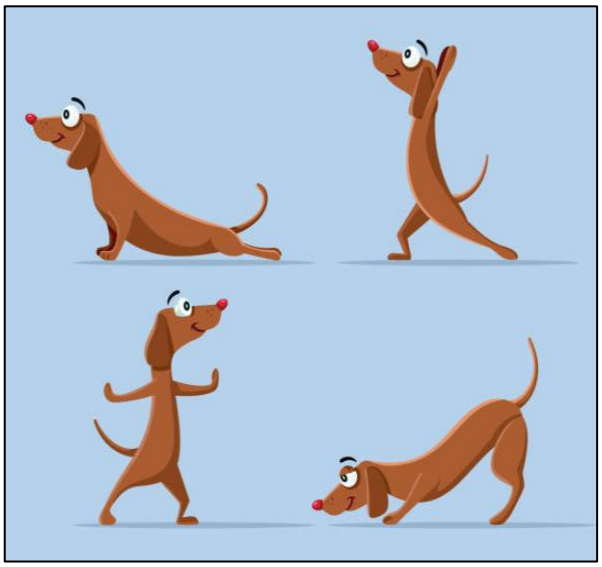
Sets: 1 Reps: 5 Freq: Multiple x / day Hold: 10 Sec
Tempo: slow

Straddle your dog, facing backwards, with your heels touching each other just behind your dog's front feet. Straighten your knees slightly, bend over (keeping your back fairly flat), and run your hands down the side or your dog until you are able to anchor them onto the pelvis. Push slow and steady. Be sure not to dig your finger tips into the groin. Release slowly.

THE WRAP UP

From the research above we can say the following.

1. Traction can increase disc height.
2. Traction can increase foraminal spaces
3. Traction can reduce the size of disc herniations
4. Traction can stabilize intervertebral disc pressures
5. Traction can help with disc regeneration
6. Traction can help restrain the degree of tissue inflammation in degraded discs
7. Traction can improve nutrient transportation and cell viability.
8. For patients with sciatica, traction improved motor abilities and improved diminished reflexes



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