

Supine Cervical Traction After Anterior Cervical Discectomy and Fusion: A Case Series

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ABSTRACT

Background and Purpose: Cervical traction has been used for more than 50 years for the treatment of cervical disk pathology. However, there is a paucity of research in regard to the use of postoperative traction following surgery. The purpose of this case series is to describe evidence-based treatment using cervical traction for herniated nucleus pulposus (HNP) after anterior cervical discectomy and fusion (ACDF) in the cervical spine. **Methods:** This case series includes two patients with discogenic symptoms, including radicular symptoms and pathology in an area adjacent to an ACDF. In both cases, treatment was performed more than one year post ACDF and consisted of continuous cervical traction in supine using 15 to 17 pounds at a 12° or 20° angle for 10 to 20 minutes. **Findings:** After treatment with supine cervical traction, two patients with discogenic pathology and radicular symptoms had a significant reduction in symptoms and at least partial resolution of myopathy/radicular symptoms, including numbness and weakness. **Clinical Relevance:** Clinicians may be hesitant to use cervical traction after a patient has had ACDF surgery. This article offers examples of two cases in which patients status post ACDF improved with therapy, including the use of cervical traction. **Conclusion:** Caution should be taken when using cervical traction on the postoperative patient. However, in patients at least one year post ACDF, cervical traction may be a viable treatment for indicated pathology.

Key Words: radiculopathy, myopathy, herniated disk, herniated nucleus pulposus

INTRODUCTION

Traction is the application of a mechanical force applied to the body to separate joint surfaces and elongate soft tissue.¹ James Cyriax popularized traction for the lumbar spine in the 1950s and 1960s. Cervical traction has been used ever since that time.^{2,3} Traction can be performed by multiple methods, including inversion, manual,

or mechanical force. This force can be self applied by the patient, manually by a clinician, or through the use of a mechanical device. Research shows that cervical traction outcomes are superior in the supine versus the seated position.^{2,4-6} Inversion tables have been used for traction, but are not as effective.⁷ The exact amount of pressure exerted on the spine at different angles is not quantifiable, hyperextension of the cervical spine is a concern, and patients often have difficulty relaxing in the inverted position.

The force necessary to distract the cervical spine has been reported to be approximately 7% of the patient's body weight.⁴ Akinbo⁸ found that 10% of body weight was ideal to relieve pain and restore mobility. Other authors^{2,9,10} found that 11.34 kg to 20.41 kg (25 to 45 lbs) of force is necessary to produce separation of the cervical spine. Damage to cervical structures has been documented when a traction force of 54.43 kg (120 lbs) was used.¹¹

Variations in the angle of applied force has been studied by Colachis and Strohm,² and Saunders and Saunders⁶ reports that the ideal cervical traction angle is 25° to 30°. Hseuh et al¹² found that traction at 30° was most effective for C4-5 and C5-6, and that 35° was most effective for C6-7. Vaughn et al¹³ studied cervical traction, noting more intervertebral separation at 0° than at 30°.

The effectiveness of cervical traction is still being debated and there continues to be a dearth of research on treatment for a cervical herniated nucleus pulposus (HNP).⁶ Imaging before, during, and after traction have demonstrated a change or movement of the HNP away from nervous structures in certain cases.⁶

Eck et al¹⁴ demonstrated that after a fusion is performed, there is increased intradiskal pressure on levels adjacent to the fusion. This may lead to disk degeneration and herniation over time. There is evidence to support adjacent-level herniation or degeneration following fusion.^{15,16} A PubMed search for relevant research in the interest of evidence-based practice supporting the application of cervical traction after anterior cervical

discectomy and fusion (ACDF) was futile. This led the author to perform a review of the literature to provide justification for the treatment and improve patient confidence in the safety of the treatment.

Contraindications of cervical traction include: application to areas where motion is contraindicated, acute injury or inflammation, joint hypermobility or instability, peripheralization of symptoms with traction, and uncontrolled hypertension.^{1,7,17}

Although not a contraindication, ADCF is a significant precaution. Loosening of the surgical implants, cervical instability, and failure of the surgical implants are concerns but have not been well researched. The use of cervical traction postoperatively is also not well documented, and no guidelines were found for evidence-based treatment protocols.

When considering the application of traction after a fusion, it is important to allow proper healing to help insure that no instability is present. Healing after ACDF follows the 3 phases of healing for bone and connective tissue. "Healing may be divided into stages of inflammatory response, fibroblastic repair, and maturation/remodeling. The time frames for these phases overlap one another and therefore cannot be thought of as discrete phases."¹⁸ However, approximate healing times should be reviewed to help the practitioner make educated decisions.

In adults, ligamentous tissue (most similar to disk material) may take up to 12 months for full maturation, and bone may take 4 to 16 weeks for mineralization.¹⁸ Solid healing of vertebral fractures occurs at 16 weeks, but remodeling can take years to complete.^{18,19} Therefore, radiographic evidence of healing is necessary before traction should be considered.²⁰ As a precaution against instability and/or surgical fracture, in this study, traction was not used on patients with surgeries less than 12 months old.

The cases used in this study included patient treatment following ACDF procedures after more than one year postoperatively. Both patients had follow-up appointments with their surgeons, and

were presented radiographic evidence of healing by the surgeon. Both patients had at least some symptoms consistent with clinical indications for spinal traction. These included: disk bulge or herniation, nerve root impingement, joint hypomobility, subacute joint inflammation, and paraspinal muscle spasm.^{1,6} Both patients signed an authorization to release medical information and gave verbal consent to be included in this study.

Two types of supine cervical traction are used by the author, the Saunders Cervical Hometrac (The Saunders Group, Chaska, MN) and the Care Rehab Starr Cervical Traction (Care Rehab, McLean, VA) device.

All treatments of cervical traction should begin with an explanation of the procedure to the patient as well as the risks and possible benefits. To minimize adverse responses, traction should be applied with a small amount of force at first, while paying close attention to the patient's response. One must also make sure there is no peripheralization of symptoms. The author uses diaphragmatic breathing and visual imagery techniques with patients to aid in their relaxation, which minimizes or inhibits muscle guarding.

Correction of disk protrusion by traction alone may not be sufficient for long term relief of symptoms. Therefore, as part of their treatment, patients in this study also received posture education and correction, cervical stabilization, and stretching. They were advised to return to their activities gradually.^{21,22}

CASE DESCRIPTIONS

Patient Evaluation

Patient A

This patient was a 45-year-old right-hand dominant male who presented status post ACDF at C5-6 performed 8 years prior. He presented with pain rated a 6 out of 10 at best and 9 out of 10 at worst on a visual analogue scale. The patient was taking Feldene and Percocet to control his symptoms as well as Glucophage, glyburide, and Accupril. His pertinent medical history included diabetes mellitus type II and 20 years of smoking.

He complained of difficulty lifting with the left upper extremity, pushing the left upper extremity into abduction, and difficulty sleeping. He complained of pain that radiated from the left parascapular region to the shoulder, into the third through fifth digits, and included numbness, tingling, and a "bad toothache" feeling. The patient was an avid and skilled golfer (5 handicap).

His occupation as a sales manager included desk work, driving, and computer work.

A postoperative MRI (performed 6 days before physical therapy started) demonstrated a C6-7 leftward HNP with fragment extending both superior and inferior to the interspace with cord deformity and moderate central narrowing (a small protrusion towards the right was also noted at C4-5).

Range of motion estimates were as follows--flexion: within normal limits; extension: 25% with symptoms reproduced; side bending: within normal limits bilaterally; rotation--left: 75%, right: within normal limits. Reflexes were grade two at the biceps, triceps, and brachioradialis bilaterally. Triceps and wrist flexion weakness and atrophy in the triceps muscle mass were noted. The patient was unable to perform a push-up.

Patient Treatment

The patient was treated with a "whole body" approach, including cervical stabilization, posture correction, ergonomic education, cervical and shoulder girdle stretches, moist heat, and supine traction. Keeping the spine neutral after traction was reinforced every visit (especially while transferring to sitting after traction) in order to avoid anterior disk pressure. This consisted of a total of 22 physical therapy visits.

Traction using the Saunders Cervical Hometrac at the only angle available (12°) was performed 3 times per week. The force of distraction was set to 6.80 kg (15 lbs) for 10 minutes and was increased to 7.71 kg (17 lbs) for 20 minutes. The patient's exercise program included posture correction, cervical isometrics, and stretching for the scalenes and mid-rhomboids. Progressive resistive exercises for the affected triceps, wrist flexors, and hand intrinsic were also included.

OUTCOME

The patient was discharged with a zero out of 10 pain rating on a visual analog scale (pain free), and the patient's range of motion was within normal limits in all planes. The patient denied any paresthesias or radiating pain into the upper extremities. Triceps and wrist extensor strength was improved, with the patient able to perform a full push-up with some compensation. Some weakness was still noted in the triceps as compared to the contralateral side.

Patient Evaluation

Patient B

This patient was a 36-year-old right-hand dominant male presenting status post

ACDF at C5-6 performed 14 years prior to therapy. His cervical and right arm pain ranged from one out of 10 at best to 6 out of 10 at worst on a visual analog scale. The patient was taking Aleve (Naproxen) to control symptoms. Pertinent medical history included a fusion and partial right rotator cuff tear.

The patient complained of cervical pain as well as pain radiating between the right elbow and fingertips, including the dorsal forearm and hand. These symptoms were aggravated while performing physical therapy for a partial right rotator cuff tear that occurred 7 months prior. The patient also complained of cervical stiffness, upper trapezius pain bilaterally, and a generalized "ache" in the cervical spine.

Subjective range of motion was as follows--flexion: within normal limits; extension: 75%; side bending: 25% bilaterally; rotation: within normal limits bilaterally. Reflexes were grade two at the biceps, triceps, and brachioradialis bilaterally. An upper-quarter strength screen demonstrated no significant weakness using manual muscle test grading procedures.

A postoperative MRI (performed 6 days before physical therapy started) demonstrated a C6-7 mild broad-based disk protrusion extending slightly more to the right of midline. The patient was very active: swimming the crawl for two-thirds of a mile twice per week, running 3 to 4 times per week for 3 to 4 miles at an 8-minute mile pace, and performing two sets of 25 push-ups daily. The patient worked as a corrections officer.

Patient Treatment

The patient was also treated with a "whole body" approach, including cervical stabilization, posture correction, ergonomic education, cervical and shoulder girdle stretches, moist heat, and supine traction. Keeping a neutral spine after traction was reinforced every visit (especially while transferring to sitting after traction) to avoid anterior disk compression.

Continuous cervical traction treatments started at 6.35 kg (14 lbs) for 15 minutes and were increased to 7.71 kg (17 lbs) for 15 minutes with the Starr ComfortTrac. The device was set at the largest angle, due to its targeted effect on the lower cervical spine (20°). The patient was seen a total of 20 visits with 20 treatments performed.

Outcome

The patient was discharged noting a zero out of 10 pain level on a visual analog scale

(pain free). Range of motion was within normal limits in all categories and the patient denied any paresthesias or radiating pain into the upper extremities.

DISCUSSION

The limitations of this case study approach include small sample size, no randomization, and the lack of a control group and no blinding to treatment. The fact that each patient was treated with a different device may also influence outcome. Constant traction was used, although some authors feel that intermittent traction may have produced better outcomes.²³ The angle of pull was also different on the two devices, although the herniations were at the same level in each case studied. It is possible that using a larger angle would achieve better results according to the research performed.^{2,6,12,24} The amount of pressure used was conservative compared to previous studies.^{2,4,8-11}

Evidence-based treatment for this case included a review for previous studies. Since direct studies were found, previous related research was cited to support the hypothesis that cervical traction may be of use in these cases. Outcomes would have been better controlled using a more standardized and previously validated outcome measure such as the Oswestry Disability Index or the Northwick Park Neck Pain Questionnaire.

Despite the shortcomings, these two case reports present the details of a treatment protocol not yet described in the literature, and document treatment procedures with follow-up to 12 months posttreatment. The results may be useful in the clinical determination of rehabilitation techniques for patients with well-healed ACDF surgeries who present with co-existent pathologies, such as degenerative disk disease and disk herniations.

Caution should be taken when one considers applying this knowledge to other surgeries or to other areas of the spine, as no research was found in these areas. More study is needed to determine long-term effects of traction following ACDF. It should be noted that patient A was followed for up to 12 months after treatment with no relapse. The patient even reported continued improvement in symptoms and function. Patient B was discharged just prior to the completion of this paper, and therefore, no long-term data exists for this patient.

CONCLUSION

Cervical traction is a treatment that has been used for decades with positive effects for many conditions, including HNP. These case reports show that supine cervical traction may be helpful in reducing symptoms, including radicular and myopathy symptoms, in patients status post ACDF with HNP.

Caution must be used to ensure proper healing has occurred. It is also recommended that the primary care physician and/or surgeon are in agreement with the treatment. A thorough evaluation should be performed to determine that no contraindications are present before deciding to use traction.

Treatment Protocol Generalizations for Cervical Traction following Anterior Cervical Discectomy and Fusion

1. Thorough evaluation includes securing that no contraindications exist:
 - a. where motion is contraindicated,
 - b. when there is an acute injury or inflammation,
 - c. joint hypermobility or instability,
 - d. peripheralization of symptoms with traction, and
 - e. uncontrolled hypertension.
2. Possibly contacting the surgeon or referring physician to discuss treatment rationale and secure agreement in care.
3. Explanation of risks and benefits to the patient.
4. Starting supine traction with gentle pressure. Ensuring comfort of the patient and no peripheralization of symptoms (recognizing that some discomfort may occur).

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