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Original Article

The effects of flexion-distraction and drop techniques on disorders and Ferguson's angle in female patients with lumbar intervertebral disc herniation

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Abstract. [Purpose] This study examines the effects of the flexion-distraction technique and the drop technique on disorders and on Ferguson's angle in female patients with lumbar intervertebral disc herniation. [Subjects and Methods] Thirty female patients with lumbar intervertebral disc herniation were divided into an experimental group (n=15) treated with flexion-distraction and drop techniques and a control group (n=15) treated with spinal decompression therapy. Both groups were treated three times a week over an eight-week period. [Results] In the comparison of changes within each group after treatment, both groups showed statistically significant decreases in disorders and in Ferguson's angle. [Conclusion] Flexion-distraction and drop techniques may be an effective intervention to improve disorders and Ferguson's angle in female patients with lumbar intervertebral disc herniation.
Key words: Flexion-distraction technique, Drop technique, Ferguson angle

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INTRODUCTION

Current conservative therapies for lumbar intervertebral disc herniation include medication, bed rest, physical therapy, massage, exercise therapy, manual therapy, and traction therapy[1)]. Among these, the preferred methods are manual and traction therapies. Among manual therapies, chiropractic often makes use of the flexion-distraction technique and the drop technique.

At present, flexion-distraction therapy is used for over 50% of chiropractic treatments in clinical practice[2)]. This therapy increases the disc space by widening the gap between the spinous processes. The increase creates negative pressure within the intervertebral disc space, which helps the part pushed out from the posterior intervertebral discs to move back inward[3)]. During the treatment, patients may experience a natural correction of their subluxated vertebrae[4)]. The therapy also induces lumbar traction in specific parts of the lumbar spine, and it realigns intervertebral discs through an extension of the anterior and posterior longitudinal ligaments brought about by the application of intensive exercises in the apophyseal joint[5)].

The drop technique is mainly used to correct the pelvis, the sacrum, and the thoracic and cervical vertebrae. It is based on a system that can safely treat strong joints, such as the pelvis, using a specially designed table. The technique accurately identifies the locations of the patient's major subluxations and applies an analysis method unique to the Thompson technique.

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It is the most commonly employed technique among existing chiropractic techniques[6]. A study by Kim et al.[3] also reported that the drop technique showed statistically significant positive effects on the pain and function of sciatica patients.

Although the flexion-distraction and drop techniques are widely used for various spinal diseases, the evidence of their effects has not been firmly established. This study therefore aims to verify the clinical effects of those techniques by means of a comparative analysis of their effects with the effects of the spinal decompression therapy that is frequently applied in patients with lumbar intervertebral disc herniation.

SUBJECTS AND METHODS

This study involved 30 female patients in their twenties to fifties who, due to the continuance of lumbar pain for at least three months, were inpatients or outpatients at S Orthopedic Hospital in Daegu, South Korea. They were diagnosed by an orthopedic specialist as having lumbar intervertebral disc herniation originating from the L5–S1 area. Diagnosis was based on their physical complaints and also on neurological, radiological, and clinical findings with x-ray, CT, and MRI results. On average, the experimental group treated with flexion-distraction and drop techniques (EG, n=15) was 35.0 ± 8.4 years of age, 162.6 ± 6.6 cm in height, and 57.1 ± 7.4 kg in weight. The control group (CG, n=15) averaged 36.6 ± 11.2 years of age, 161.2 ± 6.3 cm in height, and 59.5 ± 10.4 kg in weight. The test of homogeneity showed no statistically significant difference between the two groups. Ethical approval for the study was granted by the U1 University institutional review board, and all subjects read and signed consent forms in accordance with the ethical standards of the Declaration of Helsinki. As selection criteria, the subjects had to (1) score at least 17 points on the Oswestry Disability Index (ODI), (2) mark a Ferguson's angle of 30° or above, and (3) have passed at least one week since the onset of their symptoms. Those with a medical history of lumbar surgery, inflammatory diseases such as rheumatism, or contraindications for manual therapy were excluded.

A physical therapist with over 10 years of clinical experience treated the EG with the flexion-distraction technique using a Zenith-Cox flexion table (Zenith-100, USA) and the drop technique using a drop table (Zenith 440, USA). A spinal decompression device (MID 4 M Series, WIZ Medical, Korea) was used to treat the CG. Both groups received conservative physical therapies including hot pack (20 mins), interferential current (100 bps, 15 mins), and ultrasound therapies (5 mins). All subjects underwent their respective treatments three times a week over an eight-week period.

In the flexion-distraction technique, the therapist touched each patient's lumbar spinous process with the thenar of one hand. He then held the tail handle of the Cox table with his other hand and lowered the caudal pelvic section of the table. In doing so, he applied flexion-distraction motions five times for four to five seconds each time in order to apply distraction for 20 seconds in total. When moving the caudal segment downward, the therapist lowered it to around 5 cm and applied the respective motions for a total of 20 seconds. One set consisted of five repetitions, and three sets were applied to each patient. After applying the flexion-distraction technique, the therapist repeated the foramen magnum pump technique 10 times, applying flexion-distraction motions by lowering the tail unit of the table while supporting the back of the patient's head with one hand[7].

In the drop technique, each patient's pelvic and leg lengths were measured, and then it was determined whether they had cervical syndrome. Once a patient was confirmed to have lumbar and pelvic subluxations, the drop technique was applied with the patient in prone position. The positive Derifield technique was applied as follows. With the patient lying in supine position, the therapist touched the posterior superior iliac spine in the ilium with the thenar of his dominant hand for the correction and touched the opposite ischial tuberosity with his other hand to assist the correction. In this position, the therapist set the direction for pelvic drops as the anterior-inferior direction, and he performed corrections three to four times in posterior-anterior and inferior-anterior directions.

The negative Derifield technique was applied as follows. With the patient in supine position, the therapist touched the ischial tuberosity with the thenar of his dominant hand and held the wrist with his other hand to assist the correction. In this position, the therapist first performed corrections three to four times in an inferior-superior direction. He then touched the patient's anterior femoral region with the back side of his lower forearm and touched the medial posterior superior iliac spine with the caput ulnae of his upper forearm. He performed the corrections through a slight abduction of the patient's legs, elevating them with both his hands interlocked[6]. After correcting the pelvic subluxation, the therapist corrected the sacral subluxation by setting a low level of tension in the table. The level of correction for vertebral columns was limited to the lumbar vertebral column and pelvic girdle.

In the spinal decompression therapy, with the patient in supine position, the therapist fastened an air belt in the pelvic and thoracic regions using an air-grip extension and fixed the head with a head strap, thereby preventing these body regions from slipping. He then applied a sacrum extension device to maintain the lumbar lordosis. The duration of traction therapy was 20 minutes, and the ratio of hold time to rest time was set at 2:1.

The ODI was used to evaluate each patient's disorder. It was measured using the responses to ten questions about functional performance abilities on a scale ranging from 0 to 5. A higher score indicated a higher level of disorder. The scores for each item were added up, and the resulting sum was divided by 45 (the total score of the index) and recorded as a percentage (%).

Ferguson's angle was measured using a picture archiving and communication system (PACS) with a radiographic apparatus (DS-20UR, KOR). Ferguson's angle is the angle between the base of support and the horizontal plane in the sacrum on a simple radiograph of the lateral lumbar and sacral regions. A smaller angle leads to increased stability[8]. This angle was

Table 1. ODI and Ferguson's angle before and after treatment

	Group	Pre-treatment	Post-treatment
ODI (%)	EG	42.2 ± 10.0	21.9 ± 7.9*
	CG	34.4 ± 14.6	19.3 ± 8.9*
FA (angle)	EG	42.9 ± 5.4	34.2 ± 5.2*
	CG	39.4 ± 4.1	34.1 ± 4.3*

ODI: Oswestry Disability Index; FA: Ferguson's angle; EG: experimental group; CG: control group.
* Paired t-test ($p<0.01$).

measured by one radiographer without knowing the patient's symptoms or other information.

For statistical processing, paired t-tests were performed to identify changes in disorders and in Ferguson's angle in female patients with lumbar intervertebral disc herniation within each group. The statistical significance was set at $p=0.05$.

RESULTS

The results of this study showed statistically significant reductions in disorders and in Ferguson's angle in both groups ($p<0.05$) (Table 1).

DISCUSSION

This study involved 30 female patients in their twenties to fifties whose pain symptoms and neurological and radiological findings corresponded to lumbar intervertebral disc herniation originating from the L5–S1 area and whose Ferguson's angles were 30° or above. They were divided into a group in which manual therapies (flexion-distraction technique and drop technique) were applied and a group in which spinal decompression therapy was applied. Both groups were treated three times a week over an eight-week period, and their changes in disorders and in Ferguson's angle before and after treatment were observed.

Sutlive et al.[9] stated that the application of manual therapies to the lumbar spine and pelvis decreased the ODI with statistical significance. In their study of 219 patients treated using a spinal decompression device, Gionis and Groteke[10] reported that 86% experienced pain reduction. In the present eight-week study involving patients with lumbar intervertebral disc herniation, both groups showed a statistically significant decrease in the ODI. This may be because the flexion-distraction and drop techniques and spinal decompression therapy lowered pressure within the intervertebral discs by accurately decompressing the sites of lesions and gently stretching specific parts of the intervertebral discs. The therapies also reduced pain and increased mobility by creating a greater visual diameter within the spinal canal[11, 12].

Lee[13] applied chiropractic in 10 patients complaining of lumbar pain and lower-extremity radiating pain and reported that Ferguson's angles in six patients returned to normal levels. In the present study, the effects of the given therapies on Ferguson's angle within each group were verified, and the results revealed a statistically significant decrease in both groups. This may be because the manual therapies (flexion-distraction and drop techniques) and the spinal decompression therapy (using a device for inducing sacral movements) opened motor units in the posterior spine with a combination of manual force applied to the posterior spine and vertical distraction[11]. It may also be due to inducement of a correction of facet joint dysfunction, mobilization of closed vertebral joints, and reductions in pressure on the nerve roots caused by working on regions with low mobility or limited movement[14]. These effects may eventually have facilitated joint movements that had previously been limited and may have improved motor skills within the articular capsule.

This study has some limitations. It involved only a limited number of subjects selected from the patients visiting our hospital over the eight-week research period. It also focused on a limited number of sites in terms of the origin of lumbar lesions. Moreover, the subjects' daily lives could not be fully controlled, and long-term treatments were not performed. A variety of follow-up studies are therefore required to compensate for these limitations.

Conflict of interest

None.

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