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Original Article

## A Retrospective Clinical Survey of Vertebral Compression Fractures

Ji Hye Oh, Yun Kyu Lee, Jae Soo Kim, Hyun Jong Lee, Sung Chul Lim \*

Department of Acupuncture & Moxibustion, Deagu Haany University, Pohang, Korea



### ABSTRACT

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compression fracture,  
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**Background:** The purpose of this study was to review whether Korean medicine treatment was effective to maintain the spinal stability and to relieve spinal symptom by reviewing medical records of 18 vertebral compression fracture patients.

**Methods:** The subjects were 18 thoracolumbar compression fracture patients who were taken more than two lateral view x-rays of fractured vertebra from Jan, 2010 to June, 2018. They were divided into two groups: the time admitted into Department of Acupuncture & Moxibustion Medicine, Pohang Korean Medical Hospital of Daegu Hanny University from onset (Research 1) and whether or not they have a past history of osteoporosis (Research 2). Then, they were follow-up observed and compared by compression ratio and numerical rating scale (NRS) and so on.

**Results:** The amount of weekly compression rate increase of 18 patients was 1.76% per week. According to the result of Research 1, the patients group (14 patients) who were admitted into the hospital within 1-2 weeks from getting injury was 1.88% per week whereas the patients group(4 patients) who were admitted into the hospital within 3-4 weeks from getting injury was 1.22% per week. By Research 2 result, the patients group (7 patients) who had been diagnosed as an osteoporosis patient was 2.19% per week, and those (11 patients) who had not was 1.49% per week. There was a statistical significance in the change of the amount of compression rate increase in the case of Research 1, but there was not in the case of Research 2. NRS was decreased without significant difference regardless of the time admitted into the hospital and whether or not the patients had the past history of osteoporosis.

**Conclusion:** Considering that there were more amount of compression rate increase at 1-4 weeks from onset, it is necessary to offer treatment more actively on early time from onset. Further research is needed into the increase of compression rate by the patients' having a past history of osteoporosis or not. Given that NRS decreased without significant difference, it is assumed that Korean medicine treatment has a meaningful effect on relieving subjective symptom of patients who are diagnosed as vertebral compression fractures.

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### Introduction

Vertebral compression fractures can be caused by osteoporosis, disease or trauma that arises from axial loading of the spine and features anterior height loss that can be viewed by X-ray. It is usually accompanied by rupture of posterior vertebral bodies in young patients that are seriously injured, though the middle and posterior column are not damaged [1,2].

Kyphosis results from vertebral compression fractures causing curvature of the spine that can cause pain. Over time, additional vertebral body fractures may occur adjacently, triggering neurological disorders. Therefore, it is important to prevent the progression of kyphosis as soon as possible. Vertebroplasty is a procedure that is minimally invasive to relieve pain, restore

mobility and maintain the height of vertebra [3] but additional fracture can occur sooner in the adjacent vertebral body, so conservative treatment is advocated [4-6].

Vertebral compression fractures as a result of fall injury are stated in Jae-Byoung-Won-Hu-Ron [7] in Korean traditional medicine. Approximately 80% of vertebral compression fractures arise from traffic accidents, falling, or participating in sports, and fractures caused by falling are more common in the those over 75 years of age, usually due to osteoporosis [2].

Korean medicine treatment like pharmacopuncture, fire needling therapy, and electro-acupuncture are used to treat vertebral compression fracture [8]. Yang and Song [9] reported the therapeutic effects of bee venom acupuncture complex therapy for thoracolumbar compression fracture but did not assess

\*Corresponding author.

Department of Acupuncture & Moxibustion, Deagu Haany University, Pohang, Korea

E-mail: [now123@dreamwiz.com](mailto:now123@dreamwiz.com)

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compression rate related to vertebral kyphosis. Therefore, in this study compression rate change was evaluated through follow-up observations of patients' who had suffered vertebral compression fracture.

## Materials and Methods

### Subjects

Patients suffering with back pain were admitted to the Department of Acupuncture & Moxibustion Medicine, Pohang Korean Medical Hospital of Daegu Haany University from January, 2010 to June, 2018. Those patients who had breaks that had fractured, those who had seatbelt-type injuries, those with fracture-dislocations or those who had surgical or invasive treatment were excluded from this study according to the Dennis classification [10]. In total, there were 18 patients included in this study who had been diagnosed (by MRI scanning) with vertebral compression fracture. Korean medicine treatment began within 4 weeks of onset and 2 lateral view X-rays were taken within 8 weeks of onset.

### Treatment Methods

#### Acupuncture

Sterilized stainless steel needles (0.25 mm × 40 mm, Dong-bang Acupuncture Co. Korea) were used. Treatment was conducted once a day according to the patient's condition and all needles were retained for 15 minutes. The acupoints mainly used bilaterally were BL23, BL24, BL25, BL26, BL50, BL60 but BL20, BL21, and BL22 were also used [11].

#### Pharmacopuncture

Hwa-ta-hyeop-cheok points [12] around the vertebral fracture, Back-shu points [13] like BL20, BL21 and BL22 or trigger points around the waist were used. Sweet bee venom was given on the skin at 0.01% (1:1,000) (Korean pharmacopuncture research institute) in patients who showed no allergic reaction, and Ouhyl (Korean pharmacopuncture research institute) and Soyeom (Korean pharmacopuncture research institute) were selected and used when they showed an allergic reaction. Pharmacopuncture was used for treatment just before acupuncture treatment and 0.05–0.1 mL doses were inserted at each acupoint to a depth of 1 to 1.2 cm along the acupoints. The total amount per treatment was up to 0.6 mL in a 1.0 mL disposable syringe (Shina corporation, 1.0 mL, 29 G × 12.7 mL syringe).

#### Moxibustion

Bongraissuk-moxa (approximately 421.5 cm wide, 2.0 cm high) were applied to BL23, BL24, BL25, BL26 bilaterally once a day, for 10 minutes on each acupoint.

#### Herbal medication

In the acute phase, herbal medicine was used based on the therapy of Hwallyeolgeo and the therapy of Yikgeebohyul was mainly used for the chronic phase [14].

#### Physical treatment

A hot pack [1] was used to reduce the pain and relieve tight muscles twice a day. Cupping treatment was also applied bilaterally to BL21, BL22, BL23, BL24, BL25, and BL26 for between 5 to 7 minutes every day.

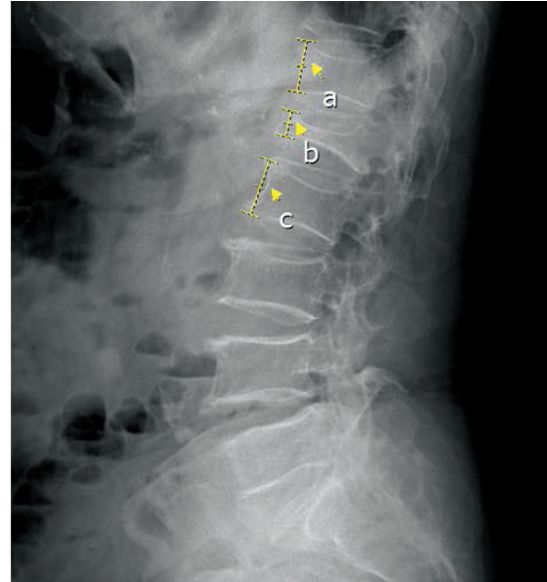


Fig. 1. Method for calculation of compression rate.

a, c, anterior vertebral body height of upper and lower vertebra; b, anterior vertebral body height of fractured vertebra.

### Evaluation Method

The gender, age, cause of sickness, fractured vertebra, follow-up period and osteoporosis status were reviewed for all 18 patients. The patients were divided firstly into 2 groups; Research 1 Group 1 which included 14 patients who were admitted to hospital between the 1st and 2nd week after injury, and Research 1 Group 2 which included 4 patients who were admitted to hospital between the 3rd and 4th week post injury. Secondly, Research 2 Group 1 was composed of 7 patients who had a past history of osteoporosis, and Research 2 Group 2 that consisted of 11 patients who had not been diagnosed with osteoporosis. Compression rate and numerical rating scale (NRS) changes were recorded before, during and after treatment for the groups.

#### Compression rate

The compression rate was calculated as:  $(m-b)/m \times 100$ . (m) is the average of (a) and (c). (b) stands for the height of the anterior side of the fractured vertebra. (a) and (c) stands for the height of each vertebra above and below it.

If there were old vertebral compression fracture above or below the adjacent segments of the fractured vertebra, the compression rate was calculated using the segments directly above or below [15] (Fig. 1).

#### Numerical rating scale

Numerical rating scale was measured by asking the patients to score their current level of pain on a scale of 0 (painless) to 10 (unendurably painful) [16]. This study was performed assuming that the patients' pain at hospital admittance was 10.

#### Statistical analysis

Statistical analysis was performed using SPSS Statistics software version 23 and Levene's equal distribution test was used to compare the 2 groups. Paired *t* test was used to examine whether there was meaningful difference in age, follow-up period, compression rate change, and NRS change between the Group 1 and 2 of both

Table 1. Patient Characteristics and Medical History.

Patients	Gender	Age (y)	Cause of sickness	Fractured vertebra	First week	Compression rate	Last week	Compression rate	Last week NRS	Follow-up period (wks)	Existence/nonexistence of osteoporosis
1	F	81	Osteoporosis	T12	1	0.15	6	11.99	2	6	Yes
2	F	55	Fall	L2	1	24.69	5	26.30	5	5	No
3	F	75	Traffic accident	L1	1	9.78	8	24.89	7	8	Yes
4	F	55	Traffic accident	L2	1	24.51	8	35.96	7	8	No
5	F	58	Traffic accident	L1	1	4.81	8	28.33	3	8	No
6	F	67	Traffic accident	T12	1	14.33	6	28.26	6	6	No
7	F	67	Traffic accident	L1	1	35.25	6	41.58	6	6	No
8	F	62	Traffic accident	L2	1	1.58	7	33.35	4	7	Yes
9	M	60	Traffic accident	L1	1	34.47	7	36.73	4	7	No
10	F	66	Traffic accident	L1	1	9.69	5	11.33	2	5	No
11	F	74	Traffic accident	L2	1	17.22	8	18.96	6	8	No
12	F	90	Osteoporosis	L2	2	11.43	7	26.42	3	6	Yes
13	F	63	Fall	L1	2	33.45	7	40.27	4	6	No
14	F	63	Traffic accident	L1	2	26.36	5	52.30	4	4	No
15	F	77	Fall	L1	3	39.96	8	49.77	2	6	Yes
16	F	69	Traffic accident	L2	3	23.82	7	29.97	10	5	No
17	F	78	Osteoporosis	L2	4	40.41	8	48.94	8	5	Yes
18	F	66	Traffic accident	L1	4	43.6	7	43.6	2	4	Yes

Research 1 and Research 2 groups.

**Results**

***Patient characteristics and medical history***

Patient characteristics and medical history are shown in Table 1.

Distribution of gender and age

Gender distribution showed there was 1 man (5.56%) and 17 women (94.44%) with a ratio of 1:17 in the patient population. Age distribution showed there were 3 patients (16.67%) in their 50's, 9 patients (50.00%) in their 60's, 4 patients (22.22%) in their 70's, 1 patient (5.56%) in their 80's, and 1 patient (5.56%) in their 90's, with a mean age of 68.11 ± 9.45 years in the study population.

Distribution of cause of illness

There were 12 patients (66.67%) who had been involved in a traffic accident, 3 patients (16.67%) who had fallen, and 3 patients

(16.67%) who had osteoporosis.

Distribution of fractured vertebra

There were 2 patients (11.11%) with a fracture of the T12 vertebra, 9 patients (50.00%) with a fracture of the L1 vertebra, and 7 patients (38.89%) with a fracture of the L2 vertebra.

Distribution of treatment period

There were 2 patients (11.11%) with a treatment period of 4 weeks, 4 patients (22.22%) with a treatment period of 5 weeks, 6 patients (33.33%) with a treatment period of 6 weeks, 2 patients (11.11%) with a treatment period of 7 weeks, and 4 patients (22.22%) with a treatment period of 8 weeks. The mean total treatment period was 6.11 ± 1.21 weeks.

Osteoporosis

There were 7 patients (38.90%) who had been diagnosed with osteoporosis and 11 patients (61.11%) who had not been previously diagnosed with osteoporosis.

### Compression rate change

In the 18 patients in this study, the mean compression rate of the patients in the first week was  $21.97 \pm 13.95\%$  and the mean compression rate of the patients in the last week was  $32.72 \pm 12.09\%$ . There was a calculated increase of 1.7% of the compression rate per week when considering the mean follow-up period.

### NRS change

Among the 18 patients, the mean pain NRS in the last week in hospital was  $4.72 \pm 2.32$ , assuming the patients' pain score when first admitted to hospital was 10.

### ***Treatment result according to the treatment starting time (Research 1)***

The patients were divided into Group 1, in which 14 patients were admitted to hospital in the 1st–2nd week from onset, and Group 2 which contained 4 patients who were admitted to the hospital in the 3rd–4th week from onset.

### Distribution of gender and age in Research 1

Gender distribution of Group 1 showed there was 1 man (7.14%) and 13 women (92.85%). Group 2 showed that there were no men and 4 women (100.00%).

Age distribution in Group 1 showed there were 3 patients (21.43%) in their 50's, 7 patients (50.00%) in their 60's, 2 patients (14.29%) in their 70's, 1 patient (7.14%) in their 80's, and 1 patient (7.14%) in their 90's. In Group 2, there were 2 patients (50.00%) in their 60's and 2 patients (50.00%) in their 70's. The mean age was  $66.86 \pm 10.05$  years in Group 1, and  $72.50 \pm 5.92$  years in Group 2 ( $p = 0.306$ ).

### Distribution of cause of sickness in Research 1

In Group 1 there were 10 patients (71.43%) who were involved in a traffic accident, 2 patients (14.29%) who had a fall, and 2 patients (14.29%) with a history of osteoporosis. In Group 2, there were 2 patients (50.00%) who had been involved in a traffic accident, 1 patient (25.00%) who had a fall, and 1 patient (25.00%) with a history of osteoporosis.

### Distribution of fractured vertebra in Research 1

There were 2 patients (14.29%) with a fracture of the T12 vertebra in Group 1, 7 patients (50.00%) with a fracture of the L1 vertebra, and 5 patients (35.71%) with a fracture of the L2 vertebra. In Group 2, there were 2 patients (50.00%) with a fracture of the L1 vertebra and 2 patients (50.00%) with a fracture of the L2 vertebra.

### Distribution of treatment period in Research 1

In Group 1, there was 1 patient (7.14%) that had a treatment period of 4 weeks, 2 patients (14.29%) with a treatment period of 5 weeks, 5 patients (35.71%) with a treatment period of 6 weeks, 2 patients (14.29%) with a treatment period of 7 weeks, and 4 patients (28.57%) with a treatment period of 8 weeks. In Group 2, there was 1 patient (25%) with a treatment period of 4 weeks, 2 patients (50.00%) with a treatment period of 5 weeks, and 1 patient (25.00%) with a treatment period of 6 weeks. The mean time period of treatment was  $6.43 \pm 1.28$  weeks in Group 1 and  $5.00 \pm 0.82$  in Group 2 ( $p = 0.054$ ).

### Osteoporosis in Research 1

In Group 1, there were 4 patients (28.57%) who had been diagnosed with osteoporosis and 10 patients (71.43%) who had not been diagnosed with osteoporosis. In Group 2 there were 3 patients (75.00%) with osteoporosis and 1 patient (25.00%) who

did not have a history of osteoporosis.

### Compression rate change in Research 1

In Group 1 the mean compression rate of the patients at the time of admittance to hospital was  $17.69 \pm 12.15\%$ , and in Group 2 it was  $36.95 \pm 8.90\%$  ( $p = 0.010$ ). The mean compression rate of the patients at the time when they were last admitted to the hospital was  $29.76 \pm 11.37\%$  in Group 1 and  $43.07 \pm 9.15\%$  in Group 2 ( $p = 0.049$ ). The early compression rate was higher in Group 2 than in Group 1 ( $p = 0.01$ ), showing a significant difference between the 2 groups. The mean compression rate in the last week was also higher in Group 2 than in Group 1, but the difference between the 2 groups reduced from 19.26% to 13.31%. The  $p$  value of the 2 groups was 0.049 showing that there was also a significant difference between them. There was a calculated increase of 12.07% of the compression rate between the first week and the last week in Group 1 and 6.12% in Group 2. The increased amount of compression rate per week was 1.88%/week in Group 1 and 1.22%/week in Group 2 considering the difference of mean follow-up period of each group (Fig. 2).

### NRS change in Research 1

The mean pain NRS in the last week of patients who were admitted to hospital was  $4.50 \pm 1.70$  in Group 1 and  $5.50 \pm 4.12$  in Group 2 assuming the patients' pain score when first admitted to hospital was 10 ( $p = 0.665$ , Fig. 3).

### ***Treatment result according to the existence or nonexistence of osteoporosis (Research 2)***

The patients were divided into 7 patients (Group 1) who had a past history of osteoporosis and 11 patients who had not been diagnosed with osteoporosis in the past.

### Distribution of gender and age in Research 2

All patients in Group 1 were women, and in Group 2, there was 1 man (9.09%) and 10 women (90.91%). Age distribution showed that in Group 1, there were 2 patients (28.57%) in their 60's, 3 patients (42.86%) in their 70's, 1 patient (14.29%) in their 80's, and 1 patient (14.29%) in their 90's. In Group 2, there were 3 patients (27.27%) in their 50's, 7 patients (63.64%) in their 60's, and 1 patient (9.09%) in their the 70's. The mean age was  $75.57 \pm 9.33$  years in Group 1, who were significantly older than the patients in Group 2 whose mean age was  $63.36 \pm 5.99$  years ( $p = 0.004$ ).

### Distribution of cause of sickness in Research 2

In Group 1, there were 3 patients (42.86%) with a previous history of osteoporosis, 3 patients (42.86%) who had been involved in a traffic accident, and 1 patient (14.29%) who had a fall. In Group 2, there were 9 patients (81.8%) who had been involved in a traffic accident, 2 patients (18.18%) who had a fall, and no patients with osteoporosis.

### Distribution of fractured vertebra in Research 2

In Group 1 there was 1 patient (14.29%) with a fracture of the T12 vertebra, 3 patients (42.86%) with a fracture of the L1 vertebra and 3 patients (42.86%) with a fracture of the L2 vertebra. In Group 2, there was 1 patient (9.09%) with a fracture of the T12 vertebra, 6 patients (54.55%) with a fracture of the L1 vertebra, and 4 patients (36.36%) with a fracture of the L2 vertebra.

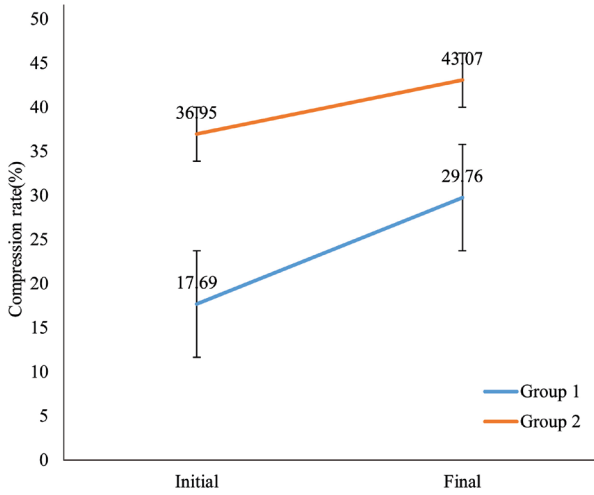


Fig. 2. Compression rate change (Research 1).

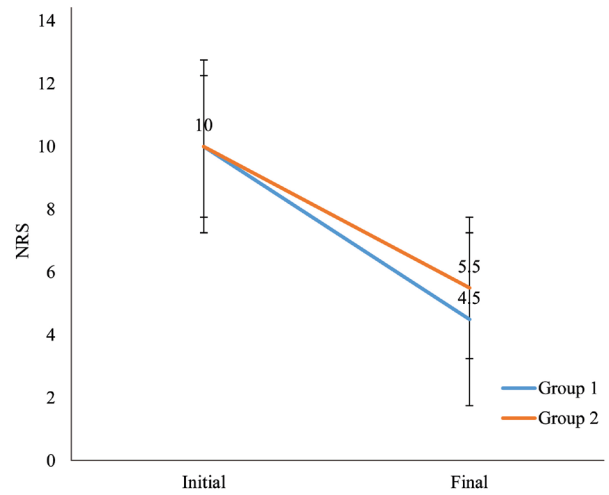


Fig. 3. NRS change (Research 1).  
NRS, numerical rating scale.

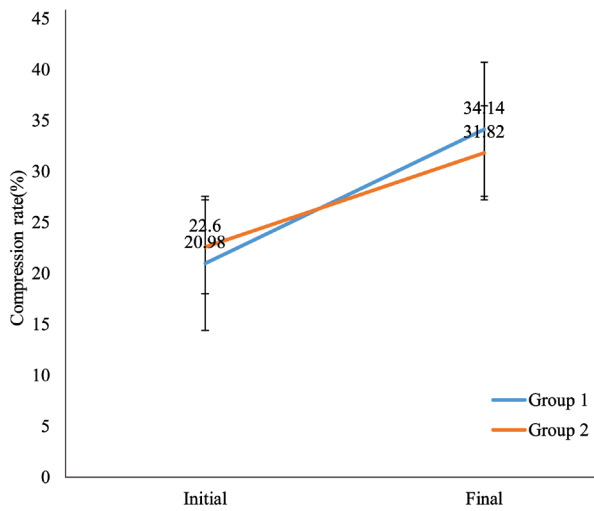


Fig. 4. Compression rate change (Research 2).

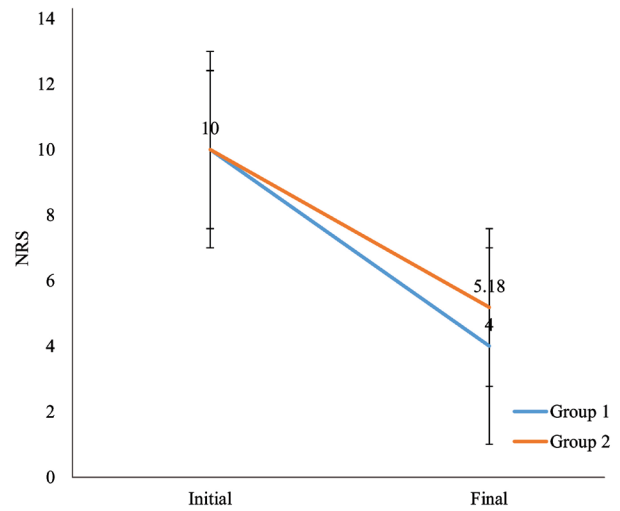


Fig. 5. NRS change (Research 2).  
NRS, numerical rating scale.

Distribution of treatment period in Research 2

In Group 1, there was 1 patient (14.29%) that had a treatment period of 4 weeks, 1 patient (14.29%) that had a treatment period of 5 weeks, 3 patients (42.86%) that had a treatment period of 6 weeks, 1 patient (14.29%) that had a treatment period of 7 weeks, and 1 patient (14.29%) that had a treatment period of 8 weeks. In Group 2, 1 patient (9.09%) had a treatment period of 4 weeks, 3 patients (27.27%) had a treatment period of 5 weeks, 3 patients (27.27%) had a treatment period of 6 weeks, 1 patient (9.09%) had a treatment period of 7 weeks, and 3 patients (27.27%) had a treatment period of 8 weeks. The mean treatment period was  $6.00 \pm 1.29$  weeks in Group 1, which was not significantly different to Group 2 with a mean of  $6.18 \pm 1.40$  weeks ( $p = 0.786$ ).

Compression rate change in Research 2

In Group 1 the mean compression rate of the patients at the time

of admittance to hospital was  $20.98 \pm 19.48$ , and similar to that in Group 2 ( $22.60 \pm 10.11$ ;  $p = 0.845$ ). The mean compression rate of the patients at the time when they were last admitted to hospital was  $34.14 \pm 14.08$  in Group 1, which was not significantly different to Group 2 ( $31.82 \pm 11.28$ ;  $p = 0.704$ ). The increased amount of compression rate between the first week and the last week was 13.16 in Group 1 and 9.22 in Group 2. The increased amount of compression rate per week was measured as 2.19%/week in Group 1 and 1.49%/week in Group 2 considering the difference of mean follow-up period of each group (Fig. 4).

NRS change in Research 2

In Group 1, the mean pain NRS was  $4.00 \pm 2.52$  in the last week patients were admitted to hospital, and  $5.18 \pm 2.18$  in Group 2 assuming the patients' pain score when first admitted to hospital was 10 ( $p = 0.306$ , Fig. 5).



## Discussion

Conservative treatment is possible when anterior height loss is less than 40% and kyphosis angle is less than 30° in vertebral compression fracture and stable burst fracture [17, 18].

Suk [19] suggests that conservative treatment could be possible even when anterior height loss is less than 50%. When the compression of anterior of vertebra is more than 40%-50%, posterior ligamentous complex and vertebra facet joint can be easily damaged and result in delayed spinal instability or increased kyphotic angle. In addition, when the radiologic change of fractured vertebra is more than 2° the posterior ligamentous complex can be damaged. In cases of spinal instability or vertebral fracture accompanied with neurological disorder or serious transformation, surgical treatment can be conducted to provide stability after restoring the damaged parts into the original anatomical arrangement and fixing them. If the degree of damaged to the vertebra does not cause stability problems, a conservative treatment can be implemented [2]. Stability is an important factor in deciding a treatment and compression rate and kyphotic angle are useful diagnostic measurements [14]. In this study, Korean medicine treatment was reviewed to determine whether it was effective for maintaining spinal stability and to relieve spinal symptoms by measuring compression rate progression in patients with vertebral compression fractures. The patients' subjective pain reduction was also assessed in relation to the existence or nonexistence of a past history of osteoporosis. The effects of whether there was an increase of compression rate or not may be useful in determining whether to conduct conservative treatment.

Worsening of osteoporosis caused by immobilization is a disadvantage of conservative treatment, with an increased risk of additional fracture and depression, however, complications and side effects like vertebral necrosis, decubitus, decreased exercise tolerance and reduced abdominal space were not observed.

The follow-up period was determined to be 8 weeks from onset. One of the reasons for this was that there may not be enough patients to perform follow-up observations, however, the main reason was that 8 weeks is the period in which compression was most noticeable according to a report by Koh and Park [15].

Statistical analysis of Research 1 (patients admitted in Weeks 1 to 2, compared with Weeks 3 to 4) showed that there was no significant difference between the 2 groups in terms of age. There were overwhelmingly more women, and traffic accident was the largest cause of sickness in both groups. In Group 1 (Weeks 1 to 2), the most common injuries were to L1 (7 cases) was the largest, followed by L2 and T12, whereas in Group 2 (Weeks 3 to 4), fractured vertebra in L1 (2 cases) and L2 (2 cases) were observed, but not in T12. In Group 1, X-ray review and Korean medicine treatment were performed between the 1st and 2nd week from onset and the treatment and follow-up observations ended between the 5th and 8th week. For Group 2, X-ray review and Korean medicine treatment were performed between the 3rd and 4th week from onset, and the treatment and follow-up observation ended between the 7th and 8th week. The mean follow-up period for Group 1 was 1.43 weeks longer than Group 2, which approached a statistically significant difference ( $p = 0.054$ ).

The reason that the compression rate of initial treatment was higher in Group 2 than Group 1, is thought to be because the compression of vertebra had progressed further in patients in Group 2 who were admitted to hospital at the 3rd–4th week from onset, compared to Group 1 who were assessed in the 1st–2nd week from onset [15]. The compression rate per week of the 18 patients increased by 1.76%. The figure was smaller than the 1.88% in Group 2 but higher than 1.22% in Group 1. These results

suggest that more active treatment should be started earlier from onset but further research is needed.

Assessment of pain using NRS showed that in Group 1, the NRS was 4.50, and 5.50 in Group 2 during the last week. In Group 1, the NRS decreased by 5.50 and in Group 2, by 4.50 when compared with the first week. The NRS analyzed in the last week when combining Group 1 and 2 was 4.72, which shows the NRS was also reduced by 5.28 compared with the first week score. The patients' subjective pain was lessened without significant difference in both groups. Therefore, Korean medicine treatment may have a significant effect on relieving subjective symptom of patients who are diagnosed with vertebral compression fracture regardless of the starting time of treatment, but given that there was no control group, further studies are required. Given that the NRS was decreased more in Group 1 than Group 2, it may be more effective to conduct Korean medicine treatment at an earlier time from onset.

Analysis of results from Research 2 [patients with osteoporosis (Group 1), compared with patients with no osteoporosis (Group 2)], showed that patients in Group 1 were significantly older than in Group 2. Group 1 consisted of only women, whereas in Group 2, there was 1 man in a rate of 9.09%. In Group 1, vertebral compression fracture was mainly caused by osteoporosis without specific trauma or traffic accident followed by fall. In Group 2, traffic accident accounted for the majority of the fractures. L1 was the most frequently reported fractured vertebra in both groups and T12 was the lowest. There was no significant difference between the 2 groups in the follow-up period.

There was no statistically significant difference between the 2 groups in compression rate change. However, patients with a history of osteoporosis may have more progressed vertebral compression from onset compared with those without previous history of osteoporosis. Given that there was no significant difference between the 2 groups in the amount of increase of compression rate per week, Korean medicine treatment may be helpful in treating the symptoms of vertebral instability but further studies are necessary to support this observation due to the limited sample size in this study.

Assessment of pain using NRS showed that in Group 1, as the NRS was 4.00 and in Group 2, NRS was 5.18 in the last week. In Group 1, the NRS decreased by 6.00, and in Group 2, NRS was reduced by 4.82 when compared with the NRS in the first week. The patients' subjective pain was reduced in both groups although this did not reach a statistically significant difference. Therefore, it is assumed that Korean medicine treatment may have a positive effect on relieving subjective pain symptoms of patients who are diagnosed with vertebral compression fracture, regardless of pre-existence of osteoporosis.

This study has some limitations. Firstly, due to the limited sample number the findings in this study need to be confirmed in larger studies. Secondly, because the study was performed retrospectively, there was no control group and all the patients were not studied under identical conditions. In particular, there was some difficulty in comparing the compression rate because the X-ray review was not performed on the same week. Thirdly, it was also difficult to identify the treatment effect accurately on account of the Korean medicine treatment not being limited to any specific treatment. Fourthly, the research items on the subjective clinical symptoms of an individual patient were lacking. Lastly, there was a limitation in accurate analysis because the study examined patients' past history of osteoporosis but it could not measure bone mineral density before treatment. In the future, a long-term follow up study with more patients including a control group is needed, considering the above limitations. In addition, it would be pertinent to analyze

the effects of acupuncture, pharmacopuncture, moxibustion, and herbal medicine on a variety of symptoms and factors associated with vertebral compression fracture and the compression rate.

### Conclusion

In conclusion, the results in this study demonstrate that the compression rate change per week increases most between the 1st–4th week from onset, suggesting more active treatment is necessary in this early period from onset. This study shows that pre-existing osteoporosis does not have an effect on the increase of vertebral compression rate but further studies are necessary to investigate this further due to the limited sample number and intervention of external factors like Korean medicine treatment during the follow up period. Given that NRS was reduced without significant difference regardless of the time admitted to hospital and the existence of osteoporosis, it is assumed that Korean medicine treatment may have a meaningful effect on relieving subjective pain symptoms in patients who are diagnosed with vertebral compression fracture.

### Conflicts of Interest

The authors have no conflicts of interest to declare.

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