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# Treatment Results of Compression Spine Fracture: Comparison of Non-Surgical with Kyphoplasty and Vertebroplasty

**Abstract**

**Background:** Compression fractures of the spine are common complications of osteoporosis that lead to persistent pain, inability to perform daily activities, and a significant reduction in quality of life. Kyphoplasty and vertebroplasty are two semi-invasive treatments for this complication. Therefore, the purpose of this research was to evaluate and compare the treatment results obtained from the use of the two mentioned methods with non-surgical medical treatment in patients with compression fracture of the spine.

**Methods:** The cases of thoracic spine compression fracture referring to 2 teaching hospitals during a 2-years period (2015 to 2017) were retrospectively studied the results of 3 treatment methods of non-surgical, vertebroplasty and Kyphoplasty were compared by chart review and also direct questioning and examination at a minimum follow-up of one year. The evaluation of pain by VAS, and functional status Oswestry Disability Index (ODI) and SF-36 short form were completed.

**Results:** From total of 138 cases of compression thoracic spine fracture only 96 had the inclusion criteria and were entered into the study. 42 male and 54 female patients were evaluated. The patients had a minimum of 3 months and maximum of 1 year (Mean=7.5 months) follow-up. VAS score in non-surgical group was 6.75±1.32, in vertebroplasty was 3.58±1.94 and in Kyphoplasty was 2.67±1.64. The ODI scores were: 56.82±14.4, 28±15.40, and 25.64±13.52 for non-surgical, vertebroplasty and Kyphoplasty respectively. The SF-36 scores were almost similar in all 3 treatment methods.

**Conclusion:** The two methods of vertebroplasty and Kyphoplasty, in comparison with non-surgical treatment, had significantly reduced pain and better quality of life and ability of work. Therefore the two surgical treatments are preferred techniques for compression spine fractures.

**Keywords:** Osteoporosis, Vertebroplasty, Kyphoplasty, Spinal fracture, Conservative treatment

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## Introduction

The vertebral column is a major component of the upper torso of the human body, which supports the entire body such as nerves and spinal cord and ability to bend and rotate in all directions [(1)]. Damage to the vertebrae reduces people's quality of life and imposes more treatment costs [(2)]. Vertebral spine fracture is one of the most common spine injuries, divided into pathological and non-pathological (traumatic) categories. A pathological fracture occurs in a bone, which has been weakened for various reasons. Bone weakness factors are Osteoporosis, tumors, bone cysts, osteomyelitis, osteogenesis imperfecta, and multiple myeloma [(3, 4)]. The non-pathological fracture occurs in healthy bone and is mainly caused by trauma [(5)]. The vertebrae or bones of the spine are damaged when a compression fracture occurs. About 15 to 20% of the fractured vertebra height in the spine is reduced due to internal micro-fractures in compression fractures [(6, 7)]. Osteoporosis is the main and most common cause of back compression fracture, which is more common in people over 50 years old. According to recent statistics from the International Osteoporosis Foundation, one out of every three women over 50 years and one out of every five men suffer from osteoporosis-related fractures [(8)]. Lumbar compression fractures due to osteoporosis usually occur during activities with a small impact or pressure such as lifting a heavy object, simply falling, or even in cases of severe osteoporosis. Fractures occur by doing something very simple such as sneezing or coughing [(9-11)].

Severe trauma to the spine can cause mild or severe fractures, which can occur because of a heavy fall, high pressure from jumping, a car accident, or any other incident putting pressure on the spine [12, 13]. A compression fracture is associated with sudden and severe back pain, and the pain from a now-healing compression fracture continues for at least three months, but after a few days or weeks, the pain subsides sharply [14]. Non-invasive and medical pain control and relief methods include drug therapy, bed rest, a special brace (medical belt), and physiotherapy [15]. Vertebroblastic and kyphoblastic surgery are invasive treatment methods with closed surgical procedures for treating a compression fracture caused by osteoporosis or a cancerous tumor. Vertebroplasty and kyphoplasty increase the motion ability of patients due to reducing pain so that patients can do their daily activities without pain. In addition, this treatment prevents height reduction or more fractures of the vertebrae. The level of osteoporosis decreases and the possibility of lung infections and heart problems decrease in patients by increasing their motion ability [16-19]. There are different results of using a suitable treatment method to reduce pain and improve the quality of life of affected people, and limited studies have been conducted in Iran. Therefore, this study aimed to evaluate the treatment results of two methods of vertebroplasty and kyphoplasty in patients with compression fractures of the vertebral column.

## Methods

This study was conducted on people who suffered from spinal compression fractures and were subjected to medical non-surgical treatment or kyphoplasty or vertebroplasty in order to evaluate the treatment consequences. Following the approval of the proposal, the researchers obtained a license from the Research and Technology Vice-Chancellor of Kermanshah University to examine the patients' files in Taleghani and Imam Reza hospitals, Iran. The patients' files diagnosed with spinal compression fractures between 2015 to 2017 and had been subjected to the mentioned treatment methods were studied. The inclusion criteria included the presence of confirmed vertebral compression fracture caused by osteoporosis, which was treated by one of the three medical methods, vertebroplasty, or kyphoplasty. The exclusion criteria were underlying chronic diseases such as cancer, fracture with the bone lesion, or other heavy surgeries during this period.

Initially, demographic information, treatment duration and type, side effects, and other specific items were collected by a checklist before contacting the patients for face-to-face examination. Then the patients were evaluated in terms of pain intensity, daily functioning, quality of life and health with standard questionnaires. Pain intensity was evaluated with a visual analog scale (VAS), quality of daily functioning was assessed by Oswestry Disability Index (ODI), and the quality of life and health by 36-item Short Survey Questionnaire (SF-36).

### Data analysis

Descriptive and analytical statistics, including mean, median and standard deviation for quantitative variables, frequency and relative frequency, chi-square test, Fisher's exact, and paired t-test, were used in SPSS Software Version 16 to analyze the collected data. Kolmogorov-Smirnov test was applied to compare two treatment methods and the normality of the data for each group. Then, the paired t-test was used to compare each parameter. In addition, a non-parametric equivalent of these tests is used in the case of the non-normality of the data. ANOVA test was also used to evaluate all three methods.

## Results

### Demographic characteristics of patients

A total of 42 patients out of 138 patients who were candidates for the study were excluded from this research due to reasons such as not being able to contact them for follow-up, unwillingness to participate in the study, or having an underlying disease during the study, and finally, 96 patients were included. Patient questionnaires were filled out during the clinic visit. The follow-up period of the

patients included the operation day (first day), three months, six months, and one year after the operation. A total of 54 patients (56.25%) were females, while 42 patients (43.75%) were males, of whom 29 people (17 females and 12 males) received medical treatment, 36 patients (21 females and 15 males) received vertebroplasty, and 31 patients (18 females and 13 males) received kyphoplasty. No significant difference was found between the patients' gender and their total number within any of the groups ($P < 0.05$). The average age for the medical treatment group was 67±8.25 years. The average age in vertebroplasty and kyphoplasty was 64±9.35 and 65±10.14 years, respectively. There was no statistically significant difference between the groups in terms of age. Moreover, no statistically significant difference was found between the gender and age of patients at the time of treatment ($P < 0.05$).

**Pain intensity in patients according to the treatment type**

The average pain intensity with the VAS scale was 6.75±1.32 in patients treated with the medical method and 3.58±1.94 and 2.67±1.64 with vertebroplasty and kyphoplasty, respectively (Figure 1). A statistically significant difference was observed between the group treated with medical treatment and both groups treated with vertebroplasty and kyphoplasty ($P<0.001$), and patients treated with medical treatment felt more pain than the other two methods. Furthermore, no statistically significant difference was observed between the vertebroplasty and kyphoplasty groups in pain ($P=0.07$).

**Disability of studied patients based on their treatment type**

The mean intensity of disability measured by the ODI questionnaire was 56.82±14.04 in patients treated with the medical method and 28±15.40 and 25.64±13.52, respectively, in the vertebroplasty and kyphoplasty group (Figure 2). Patients treated with medical methods experienced more severe disabilities ($P<0.001$). No significant difference was detected in the intensity of disability between the two groups with vertebroplasty and kyphoplasty treatment methods ($P=0.78$). Generally, none of the patients in all three treatment groups experienced a major disability.

**Quality of life and mental status of patients based on the SF-36 questionnaire:**

The parameters of physical function, role disorder due to physical health, role disorder due to emotional health, and energy/fatigue of patients were measured with the SF-36 questionnaire (Figure 3). In addition, emotional well-being, social function, patients' pain, and general health were other parameters measured using the SF-36 questionnaire (Figure 4). Finally, the physical and mental components were calculated by the mentioned questionnaire (Figure 5).

A statistically significant difference was observed between the patients treated with the medical method compared to vertebroplasty and kyphoplasty regarding all the mentioned parameters ($P < 0.001$). However, no statistically significant difference was observed between the two groups with the treatment methods of vertebroplasty and kyphoplasty ($P < 0.05$).

**Correlation between different measured parameters based on the patients' treatment methods**

A significant correlation was observed between pain intensity and disability, as well as all components of the SF-36 questionnaire measured in this study. In addition, there was a significant correlation between pain and disability intensity, as well as all components of the SF-36 questionnaire based on the treatment type.

**Side effects of treatment methods**

No cases of treatment-related infection, pulmonary embolism, and adjacent vertebral fractures were observed in patients treated with vertebroplasty and kyphoplasty surgery after at least one year of treatment. Moreover, the fractures of adjacent vertebrae were not observed in patients treated with medical treatment after at least one year.

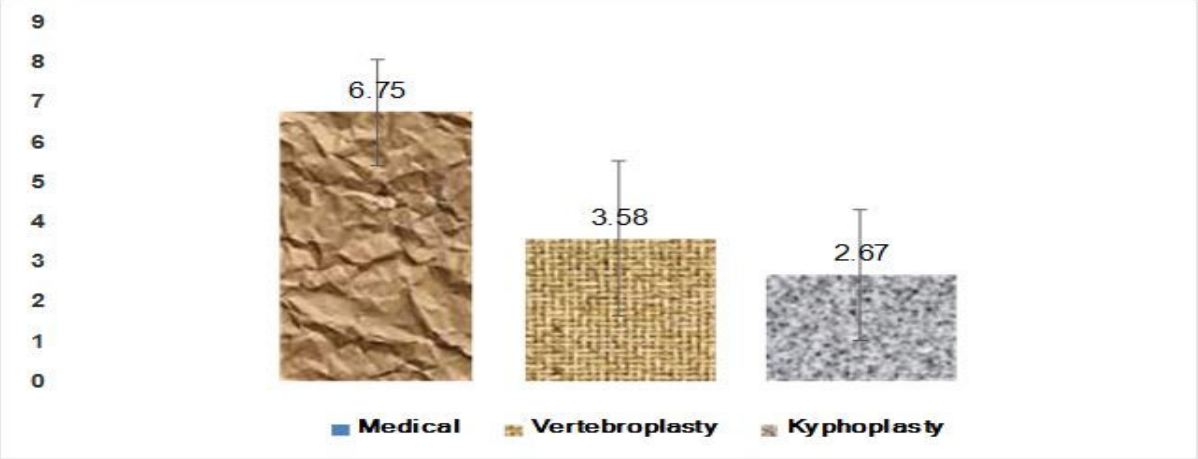


**Figure 1: The average intensity of pain felt by each treatment group**

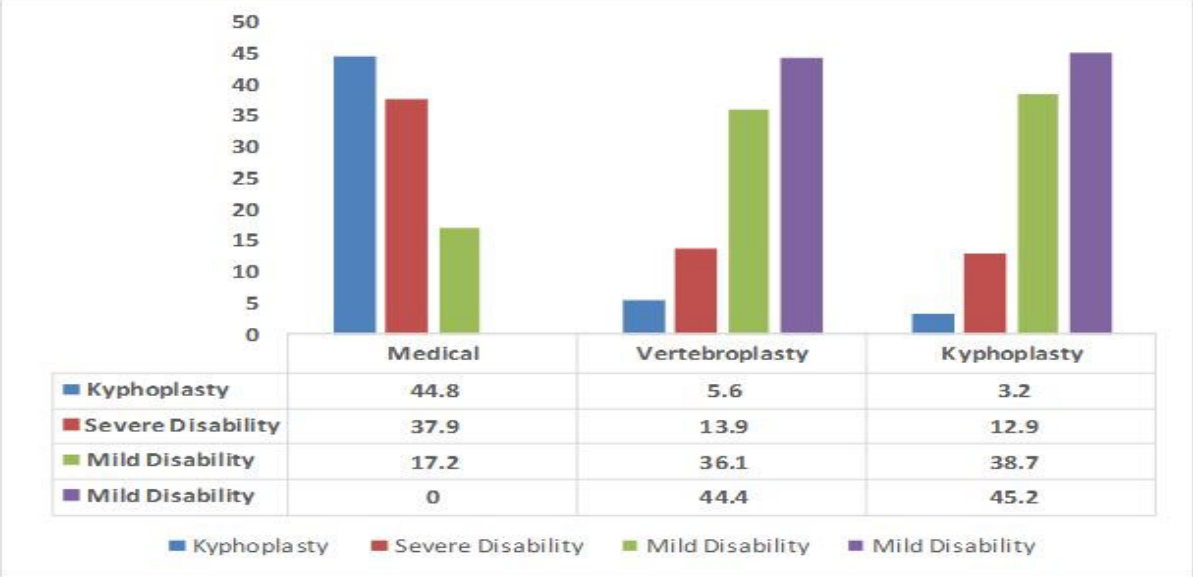


**Figure 2: The percentage of patients with disability intensity according to their treatment method**

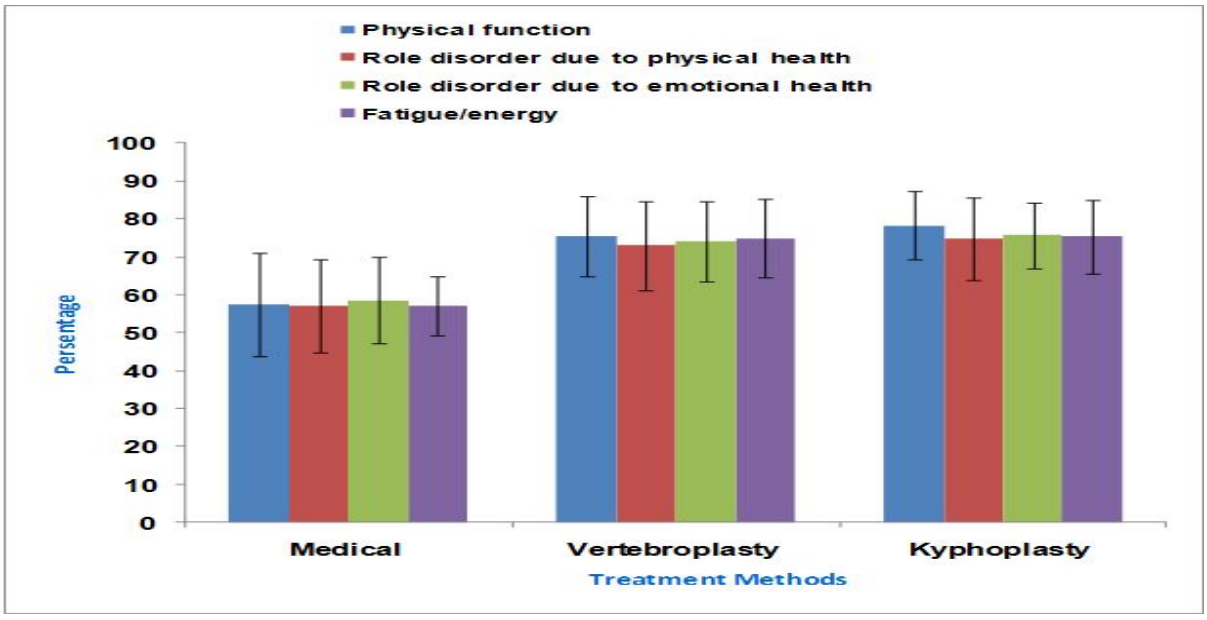


**Figure 3: The average score of physical function, role disorder due to physical health, role disorder due to emotional health, and energy/fatigue of patients according to their treatment methods**

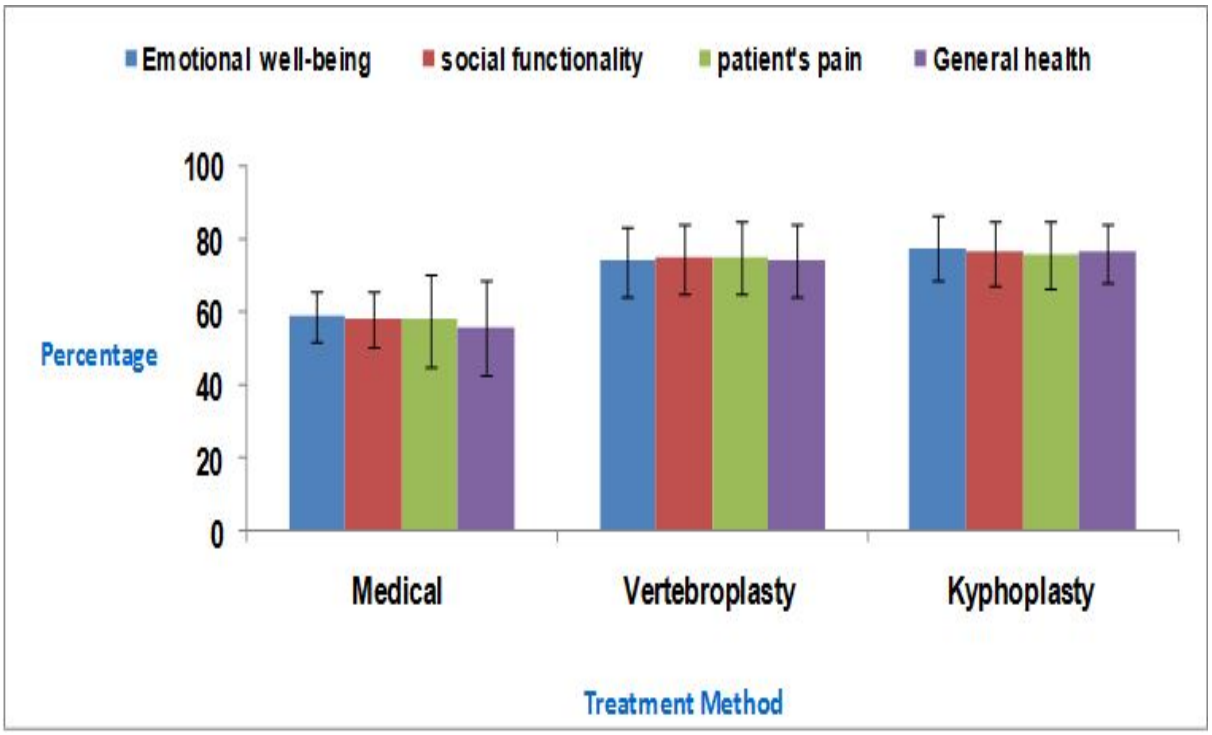


**Figure 4: The average score of emotional well-being, social functionality, pain, and general health of patients according to their treatment method**

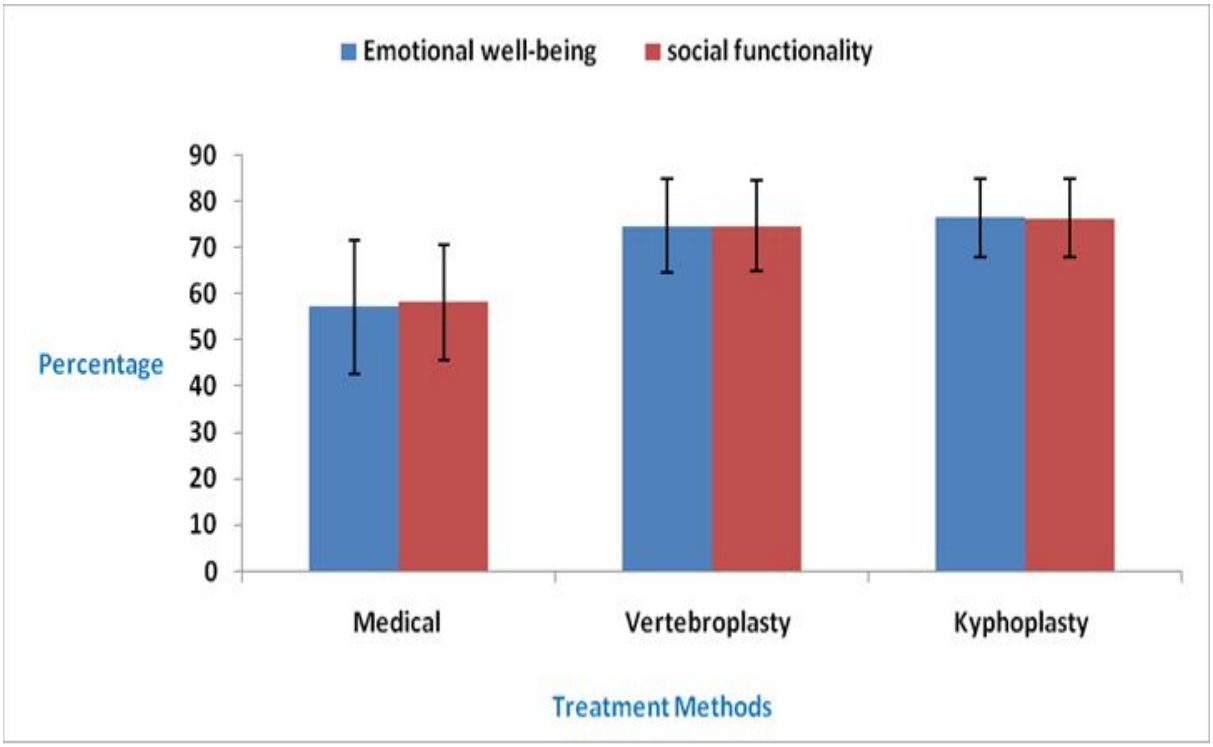


**Figure 5: The average score of the physical and psychological components of the patients based on their treatment methods**

## Discussion

This study investigated the effectiveness of vertebroplasty and kyphoplasty methods in contrast to medical treatment methods in patients with vertebral compression fractures. According to the interviews, disability index and quality of life had improved in all the mentioned methods after one year of pain. However, there was a statistically significant difference between the medical and the two mentioned surgical methods in all the mentioned indicators. In addition, there was no statistically significant difference between the two surgical methods of vertebroplasty and kyphoplasty in the mentioned indicators.

Vertebroplasty and kyphoplasty are minimally invasive procedures, but they are still surgical procedures that may have risks and complications, and pulmonary embolism, paraplegia, and infection have been reported due to these surgeries [20-22]. In this study, none of the mentioned side effects were observed, but these complications may be observed when a larger number of patients are examined due to the limited population. Therefore, evaluating the effectiveness of these methods compared to non-invasive ones is essential to decide whether they are effective enough to ignore their risk or not.

Gill et al. (2007) examined 14 vertebroplasty studies and seven kyphoplasty studies and showed that in all previous studies, both mentioned methods effectively reduced pain immediately after surgery [23]. Xiaochun et al. (2013) conducted a clinical and prospective trial to investigate the effectiveness of vertebroplasty compared to medical treatment and found no significant difference between the two treatment methods in terms of pain intensity at the end of the first and second weeks to the end of the first month after the treatment. However, a significant difference was observed between the two mentioned methods at the end of the second, sixth, and 12 months as patients treated with vertebroplasty experienced less pain than medical treatment [24]. The results of this study are consistent with those of the present study because all patients were evaluated at least one year after completing the treatment period. Due to the retrospective nature of the present study, it was not possible to evaluate the pain in a short period after implementing the relevant treatment method.

Tian et al. (2014) conducted a meta-analysis and showed that patients treated with vertebroplasty experienced significantly less pain intensity than medical treatment at the end of 48 weeks after completion of the respective treatment. Moreover, no statistically significant difference was observed between the two methods regarding new fractures of adjacent vertebrae after treatment [25]. Lamy et al. (2014) found that a new fracture may occur after some time, especially in the vertebrae adjacent to the treated vertebra in some cases after treating patients with vertebroplasty and kyphoplasty. Vertebroplasty and kyphoplasty should be considered an alternative due to their side effect and should be used when the medical treatment method has failed [26]. In this study, the pain was reduced using two surgical methods, which was significant compared to the medical treatment method. In addition, the quality of life and ability of the person was significantly increased compared to the medical treatment method. No side effects were observed in all the investigated treatment methods after at least one year of completion of the treatment procedures. The sample size was limited, and side effects may be observed with an increase in this number. On the other hand, the two surgical treatment methods reduced pain effectively, which was significant compared to the medical treatment method and can be considered the first line of treatment.

Similar results were obtained in this study by comparing two treatment methods in which pain was effectively reduced and quality of life and ability increased. There were no side effects in these methods, and both had the same effect according to the indicators. However, the other's studies have shown that these two methods have differences, and the vertebroplasty compared to kyphoplasty, is associated with a higher probability of cement leakage and lateral vertebrae fractures [27-30]. Conflicting results can be attributed to differences in sample size, individual

differences in surgeons and their expertise, nursing care, quality of surgical consumables, race, geography of life, and patients' jobs. The evaluation type of the variables, especially regarding the quality of life, was one of the sources of this difference because there are several different models and questionnaires in this field, and each of the studies has used a certain type of them, which naturally gives different results despite being standard [31-35].

## Conclusion

According to the results, the vertebroplasty and kyphoplasty methods significantly reduced pain and increased the quality of life and ability of patients compared to medical treatment, which is safe in terms of side effects.

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## Conflict of interest

The authors declared no conflict of interest in this study.

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