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Research Article

THE EFFECT OF THE JEWETT ORTHOSIS ON PAIN AND ORTHOSIS SATISFACTION IN PATIENTS UNDERGOING VERTEBROPLASTY OR KYPHOPLASTY DUE TO MULTIPLE MYELOMA: A PILOT STUDY

Aytül DURMUŞ[1], Esra ATILGAN[1], Ömür Gökmen SEVİNDİK[1], Z. Candan ALGUN[1]
[1]Istanbul Medipol University, Faculty of Health Sciences, Istanbul, Turkey
[1]Istanbul Medipol University, Faculty of Health Sciences, Istanbul, Turkey
[1]Demiroglu Bilim University, Faculty of Medicine, Istanbul, Turkey
[1]Istanbul Medipol University, Faculty of Health Sciences, Istanbul, Turkey

Keywords

Kyphoplasty,
Multiple myeloma,
Orthosis,
Vertebroplasty.

ABSTRACT

Purpose: Multiple myeloma (MM) is a malignancy characterized by uncontrolled plasma cell proliferation, often resulting in bone fractures, particularly vertebral compression fractures. Standard treatment includes vertebroplasty or kyphoplasty to restore load distribution and stabilization. Postoperatively, the Jewett orthosis is prescribed to maintain spinal stability. This study aimed to evaluate the effect of Jewett brace use on low back pain and patient satisfaction in MM patients who had undergone vertebroplasty or kyphoplasty.

Methods: Four male patients aged 30–45 years with MM and vertebral fractures treated with vertebroplasty or kyphoplasty were included. The Quebec Back Pain Disability Scale (QBPDS) assessed back pain, and the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) evaluated orthosis satisfaction. Vertebral curvature measurements were obtained one-month post-surgery to compare preoperative and postoperative vertebral height.

Results: According to the QBPDS, patients reported limitations in daily activities with a mean score of 49.25%. QUEST results showed that while the orthosis provided stabilization, the average satisfaction level was 3.85/5. Magnetic resonance imaging demonstrated an increase in vertebral height, from a preoperative mean of 1.92 cm to a postoperative mean of 2.25 cm.

Conclusion: Conservative treatment with postoperative Jewett orthosis contributed positively to vertebral stabilization. Patients experienced moderate back pain and improvements in daily living activities, and overall satisfaction with the orthosis was reported. Further studies with larger cohorts are recommended to clarify its impact on functional capacity and pain.

INTRODUCTION

Multiple myeloma is a malignant disorder characterized by the accumulation of monoclonal antibodies in the bone marrow, leading to their proliferation in the blood and urine. The disease may initially present with specific symptoms. Increased levels of monoclonal antibodies can cause lytic lesions in bone structures, particularly in the vertebrae. These lesions

Corresponding Aytül DURMUŞ ✉, aytldrms5@gmail.com
Istanbul Medipol University, Faculty of Health Sciences, Istanbul

compromise the structural integrity of the spine, resulting in pathological fractures and severe pain that negatively impacts quality of life (1-2).

Studies have shown that thoracolumbar spine fractures account for approximately 15% of all spinal fractures. While systemic oncological treatment is essential for achieving remission and long-term disease control, surgical intervention may be necessary in certain cases involving pathological vertebral fractures. The primary goal of surgery is to restore spinal stability and neurological function, thereby improving quality of life. Spinal fractures due to high-energy trauma frequently occur in the thoracolumbar region, which serves as a transition zone between the relatively immobile thoracic and the more mobile lumbar spine. Increased biomechanical stress renders this region more susceptible to injury (3 -4-5).

Vertebral fractures may lead to height loss caused by vertebral collapse, spinal instability, and even kyphotic deformity. The resulting pain and kyphosis can progressively restrict mobility and impair respiratory function, ultimately diminishing the patient's quality of life and increasing vulnerability to further complications (6).

Spinal orthoses are external supports used as primary or adjunctive tools for immobilization in various spinal disorders. These orthoses can be classified into three categories based on their function: supportive, immobilizing, and corrective. Immobilizing orthoses are commonly used postoperatively following thoracolumbar spinal surgeries. The Jewett orthosis, designed for hyperextension, prevents flexion and lateral bending, thus supporting the thoracic and lumbar spine. It features anterior sternal and pubic pads and a posterior adjustable strap to maintain a three-point pressure system. Spinal braces operate via two primary mechanisms: one involves increasing intra-abdominal pressure to reduce the net force and stress applied to the spine; the other employs three-point fixation to maintain proper spinal alignment, thereby offloading compressive forces and ensuring spinal stability and proper load distribution (7-8).

Although there is a growing body of research on spinal orthoses, the literature lacks studies focusing on orthotic use following vertebral fractures caused by multiple myeloma and treated surgically. Therefore, this pilot study aims to assess the effectiveness of the Jewett orthosis in alleviating pain and improving user satisfaction among individuals with spinal fractures due to multiple myeloma who have undergone vertebroplasty or kyphoplasty.

METHODS

Study Design

This study was conducted in 2023 with participants who were admitted to the hematology department of Medipol Mega University Hospital due to multiple myeloma, underwent surgery for vertebral fractures caused by the disease, and subsequently used a Jewett orthosis. Ethical approval for the study was obtained from the Ethics Committee of Medipol University (approval date: 14.09.2023; reference number: E-10840098-772.02-5854). All participants signed an informed consent form indicating their voluntary participation. The study was conducted in accordance with the principles of the Declaration of Helsinki for biomedical research involving human subjects. This investigation was conducted as a pilot study to obtain preliminary data on the effects of Jewett brace use on low back pain and patient satisfaction.

Participants

Four participants diagnosed with multiple myeloma who had experienced vertebral fractures and undergone vertebroplasty or kyphoplasty followed by use of a Jewett orthosis were included. Each participant was informed about the structure, purpose, and requirements of the study, and written informed consent was obtained. Inclusion criteria required individuals to be literate, able to cooperate, ambulatory, and independent in daily activities, and to have used the Jewett orthosis for at least one month. Exclusion criteria included symptoms other than fractures caused by myeloma, neurological disorders, and serious postural or deformity-related impairments that could cause balance, gait, or functional loss.

Procedure

To assess the impact of back pain on quality of life, the Quebec Back Pain Disability Scale (QBPDS) was administered. To evaluate satisfaction with the orthosis, the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) was used. Vertebral curvature was measured one month after surgery by a specialist physician to compare vertebral height based on preoperative (Pre-op) and postoperative (Post-op) magnetic resonance imaging (MRI) scans.

Quebec Back Pain Disability Scale (QBPDS)

The QBPDS was developed in French and English as a specific tool for evaluating functional disability in patients with back pain. Functional disability is defined as difficulty in performing simple physical activities. The scale consists of 20 items categorized into six areas: resting/lying down, sitting/standing, walking, range of motion, bending and lifting/carrying, and daily activities. Each activity is rated on a 6-point scale, where higher scores indicate more severe disability (0 = no difficulty; 5 = unable to perform). The maximum total score is 100. The Turkish version has been validated and shown to be reliable (9). Vertebral measurements were performed once, after one month of orthosis use post-surgery.

Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST)

The QUEST is a standardized survey commonly used to assess satisfaction with various assistive technologies. Satisfaction is defined as the user's critical assessment of the assistive device, which may be influenced by expectations, perceptions, attitudes, and individual characteristics. The survey consists of 12 items—8 relating to device satisfaction and 4 to service satisfaction. The Turkish adaptation and validation were conducted by Yavuz Yakut and colleagues (10). Vertebral measurements were taken once, after one month of orthosis use post-surgery.

Vertebral Curvature Measurement

At the time of fracture, MRI was used to evaluate vertebral height loss at the injury site prior to surgery. Preoperative and postoperative MRI scans were used to measure the mid-body vertebral height. These measurements were taken from MR images and compared accordingly (Figure 1) (11).

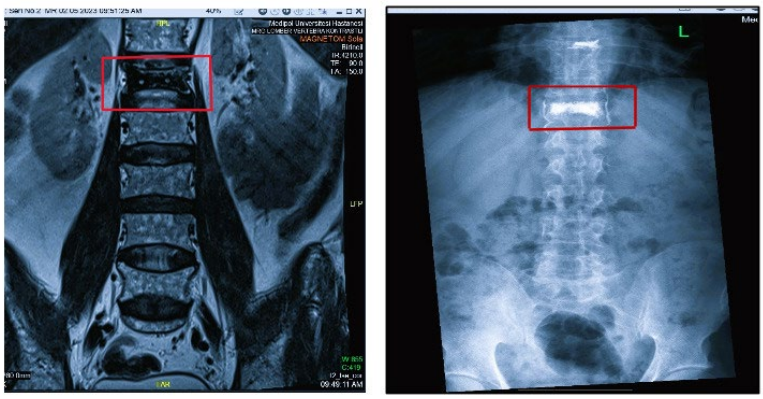

Figure 1. Pre-operative and postoperative vertebrae

Statistical Analysis

As this is a pilot study, the results of the questionnaires completed by the four participants were analyzed using mean and standard deviation.

RESULTS

Four male participants between the ages of 34 and 51 who met the inclusion criteria were enrolled in the study. Among them, three had undergone vertebroplasty only, while one had undergone both vertebroplasty and kyphoplasty. Demographic information of the participants is presented in Table 1, and the results of the Quebec Back Pain Disability Scale (QBPDS) and the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) are presented in Table 2.

Tablo 1. Demographic information

	Age	**Gender**	**Operation**	**Jewett Orthosis Usage Time**
CASE 1	44	Male	Vertebroplasty	1-2 Years
CASE 2	34	Male	Vertebroplasty	0-6 Months
CASE 3	40	Male	Vertebroplasty	1-2 Years
CASE 4	51	Male	Vertebroplasty and Kyphoplasty	0-6 Months

Quebec Back Pain Disability Scale (QBPDS) Results

Participants' perceived back pain following surgical intervention was assessed using the QBPDS. According to the results (Table 2), the average limitation in daily life activities due to back pain was calculated as X = 49.25%. Additionally, the median and standard deviation results are presented in Table 2.

Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST)

Participants’ satisfaction with the Jewett orthosis was evaluated using the QUEST. The average satisfaction score was X = 3.85 out of 5, indicating a generally positive perception of the orthosis in terms of comfort and support. Additionally, the median and standard deviation results are presented in Table 2 (Table 2).

Table 2. Survey Results

Surveys		X	SS	M
Quebec Back Pain Disability Scale (QBPDS)		49.25	14.72	47
Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST)	**Device Satisfaction**	3.87/5	0.69	3.995
	Service Satisfaction	4.06/5	0.875	4.125
	Total QUEST	3.85/5	0.48	3.885

X: mean, SD: standard deviation, M: Median

Vertebral Height Measurement

Comparative measurements of vertebral height were obtained from preoperative and postoperative MRI scans. The mean vertebral height increased from **Pre-op X = 1.92cm** to **Post-op X = 2.25cm**, indicating an improvement in spinal alignment and stabilization following orthosis use. Additionally, the median and standard deviation results are presented in Table 3.

Table 3. Preoperative and postoperative vertebral body mid-height

	Pre-operative vertebral height	X	SS	M	Postoperative vertebral height	X	SS	M
CASE 1.	1.34 cm	1.925	0.415	2.065	1.82 cm	2.2375	0.3065	2.315
CASE 2.	1.92 cm				2.20 cm			
CASE 3.	2.23 cm				2.50 cm			
CASE 4.	2.21 cm				2.43 cm			

X: mean, SD: standard deviation, M: Median

DISCUSSION

The majority of patients diagnosed with multiple myeloma undergo surgical intervention due to vertebral fractures and require the use of assistive devices postoperatively. To date, no studies in the literature have specifically examined the use of orthoses following surgery in such cases. The findings of our pilot study indicate that patients who used the Jewett orthosis after surgery experienced a reduction in pain and an improvement in vertebral height. Although these patients simultaneously received anti-myeloma therapy, the positive outcomes cannot be

attributed solely to orthosis use. Nevertheless, it is plausible that the absence of orthotic intervention might have led to poorer postoperative results. Therefore, we believe that the use of an orthosis plays an important role in maintaining the benefits of surgical intervention.

A study by Keshavarzi et al. reported that hyperkyphotic posture, resulting from altered vertebral biomechanics, adversely affects quality of life, lung function, and physical capabilities, and increases the risk of falls, fractures, and mortality. One of the aims of our study was to investigate whether supporting spinal stability in addition to anti-myeloma treatment could reduce these risks and improve quality of life by alleviating myeloma-related pain (12).

Matussek et al. emphasized that orthotic treatments used as adjunctive therapy after vertebral fractures should be considered as part of a multidisciplinary approach. Our findings align with this view: postoperative imaging showed a return to near-normal vertebral height, accompanied by reduced pain and improved quality of life (13).

De Sire et al. found that the use of spinal orthoses was associated with improvements in pain intensity, physical function, and quality of life. Our results support this, suggesting that the Jewett orthosis, when used alongside surgery and anti-myeloma treatment, contributes to spinal stability and musculoskeletal alignment, thereby significantly reducing perceived back pain (14).

Abe et al. reported that patients with spinal fractures who were monitored during a rehabilitation program while using a Jewett orthosis completed the initial treatment phase without serious adverse events, thanks to the stabilization provided by the orthosis. According to our QUEST results, the Jewett orthosis helped restore spinal integrity within approximately one month, with patients expressing high satisfaction. Additionally, the orthosis did not excessively limit daily activities, allowing patients to complete their initial recovery phase without major complications (15).

Taher et al. demonstrated that, in spinal fractures arising from other indications, the stabilization provided by orthoses exerts a beneficial influence on spinal biomechanics, thereby reinforcing surgical outcomes. These findings align with the results of our pilot study (16).

Yokoyama et al. compared vertebral height outcomes following three different procedures for vertebral fractures and concluded that vertebroplasty offered more advantages and benefits. Our study supports the idea that the Jewett orthosis, when used in addition to vertebroplasty or kyphoplasty, is beneficial in promoting recovery and adaptation by limiting excessive movement and enhancing stability (17).

Limitations of the Study

In our study, the evaluations of participants with orthoses and postoperative assessments were conducted at one month after the procedure. Some of our participants used the Jewett orthosis for longer than one month; however, since no MRI imaging was performed after the maximum period of orthosis use, the measurements could not be evaluated. Therefore, further studies are recommended to obtain clearer and more diverse data.

As this is a pilot study, we believe that the continuation of the research with a larger sample size is essential in order to share more conclusive results with the scientific community. Furthermore, we recommend that future studies focus more extensively on orthotic interventions used in this patient population to better evaluate their clinical and functional outcomes.

CONCLUSION

In patients with vertebral fractures due to multiple myeloma, the use of a Jewett brace following vertebroplasty or kyphoplasty has been shown to provide a positive effect on impaired spinal stability in addition to anticancer therapy, thereby contributing to the reduction of low back pain. Patients are generally satisfied with the ease of use of the brace, and the Jewett brace does not significantly limit their daily life activities. The preliminary results of our study support the use of the Jewett brace as a routine treatment procedure following vertebroplasty or kyphoplasty.

Ethics Committee Approval: Ethics approval was obtained from the Istanbul Medipol University Non-Interventional Clinical Research Ethics Committee (File No: E-10840098-772.02-5854, Date: 14.09.2023).

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