Original article

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Factors affecting the quality of life of patients after tubular microdiscectomy

Yuriy Y. Chomolyak [1,2], Yullia H. Khymynets [1,2], Anastasiia D. Ivashchenko [3]

[1] Department of Surgical Disciplines Institute of Postgraduate and Pre-university Education, Uzhhorod National University, Uzhhorod, Ukraine
[2] Limited Liability Company "Medical Center „Diamed„", Uzhhorod, Ukraine
[3] TUZ Ubezpieczenia Insurance Company Joint-Stock Company (TUZ Ubezpieczenia TU S.A.), Warsaw, Poland

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Address for correspondence*:*
Khymynets Yuliia Georgiivna, Department of Surgical Disciplines Institute of Postgraduate and Pre-university Education, Uzhhorod National University, 20 Ivan Korshynskyi Street, Uzhhorod, 88000, Ukraine, e-mail: juliyachiminets@gmail.com

Generally accepted factors that may affect a patient's quality of life after surgery include excess body weight and heavy physical activity before surgery. However, randomized controlled clinical trials (RCTs) evaluating the quality of life of patients with these factors after tubular microdiscectomies remain limited.

Objective: to assess the quality of life of patients after tubular microdiscectomy and to establish prognostic factors that affect this indicator.

Materials and methods: The study included 160 consecutive patients who underwent tubular microdiscectomy for herniated intervertebral discs; selected according to the predefined inclusion and exclusion criteria and assessed using the Oswestry Disability Index (ODI). The operations were performed in one institution (Diamed Medical Center, Uzhhorod) by the same surgical team. To identify the most significant variables, backward stepwise regression analysis was applied. The initial model included all potentially relevant variables, after which predictors that did not show a statistically significant association with the dependent variable were sequentially removed. In addition, pairwise correlations among all studied variables were assessed.

Results: It was found that women who had performed heavy physical labor before the operation demonstrated greater variability of ODI indicators compared with women who had not performed heavy physical labor and men from both groups. Prognostic factors for deterioration in quality of life after tubular microscopic discectomy include the combination of heavy physical labor before the operation and a high Body Mass Index (BMI). This pattern became more with increasing patient age.

Conclusions: The quality of life of patients after tubular microscopic discectomy does not depend significantly on individual factors such as gender, age, and physical labor before the operation. Tubular microdiscectomy does not reduce individual factors that potentially affect well-being after the operation; however, it minimizes negative factors during the operation itself and the early postoperative period. To establish the effectiveness of tubular microdiscectomy, further studies are needed to compare pre- and postoperative indicators of different discectomy techniques.

Keywords: *low back pain; herniated disc; spinal surgery; tubular microdiscectomy*

Introduction

Low back pain is one of the most common pathological symptoms among the adult population worldwide. In recent years, patients have increasingly reported back pain regardless of social status, standard of living, occupation, age, or sex [1]. Low back pain represents one of the most serious public health problems, with a lifetime prevalence of 84%. The prevalence of chronic low back pain is approximately 23%, whereas the rate of disability reaches 11–12% [2]. Individuals engaged in heavy physical labor, those with concomitant physical and mental disorders, smokers, and individuals with obesity are at the highest risk of developing low back pain.

In 1986, R.A. Deyo classified low back pain into three categories: mechanical pain, non-mechanical pain, and pain associated with visceral diseases. Intervertebral disc herniation is a component of mechanical low back pain and significantly reduces patients' quality of life [3].

Intervertebral disc herniation is defined as a localized displacement of a degeneratively altered portion of the intervertebral disc beyond its anatomical boundaries, resulting in compression of the spinal cord and spinal nerve roots [4].

Low back pain caused by intervertebral disc herniation may lead to persistent neurological deficits in some patients, including paresis, decreased proprioceptive reflexes, sensory disturbances, and pelvic organ dysfunction. In patients without neurological deficits, pain decreases within the first 6 weeks after symptom onset in 70% of cases under pharmacological treatment. Most authors recommend considering surgical intervention for the remaining patients [5, 6].

According to the results of a 2019 meta-analysis, surgical treatment of patients with intervertebral disc herniation refractory to pharmacological therapy for 6 weeks is more effective than continued conservative medical management [7].

In the twenty-first century, numerous surgical techniques for the treatment of intervertebral disc herniation have been proposed, ranging from conventional open discectomy to minimally invasive procedures. The popularity of minimally invasive approaches has increased substantially in recent years [8].

The tubular discectomy technique was first described in 1997 by K.T. Foley and M.M. Smith as microendoscopic discectomy involving endoscopic assistance [9]. However, there remains a lack of RCTs evaluating the effectiveness of tubular discectomy performed using a surgical microscope [10–12].

Objective: to assess the quality of life of patients after tubular microdiscectomy and to identify prognostic factors influencing this outcome.

Materials and methods

Study participants

A total of 160 consecutive cases of surgical treatment for intervertebral disc herniation using tubular microdiscectomy performed at the Medical Center "Diamed" (Uzhhorod, Ukraine) between 2021 and 2024 were selected for the study.

The study protocol was approved by the Ethics and Bioethics Committee of the Limited Liability Company Medical Center "Diamed" (Minutes No. 45/1 dated September 10, 2025).

Inclusion criteria:

Patients with clinically significant neurological symptoms (low back pain, lower extremity paresis, decreased proprioceptive reflexes, sensory disturbances, and cauda equina syndrome), radiological evidence of lumbar disc herniation confirmed by magnetic resonance imaging, and resistance to conservative treatment were included in the study.

Exclusion criteria:

The exclusion criteria were a history of lumbar spine surgery, involvement of more than one spinal segment, diseases of other organs and systems precluding surgery, satisfactory response to pharmacological treatment, and foot plegia without pain syndrome.

Group characteristics

The study included 160 patients whose data were anonymized. A retrospective assessment was performed using the following variables: sex, age, body mass index (BMI), duration of analgesic use before surgery, duration of symptoms before surgery, engagement in heavy physical labor, duration of analgesic use after surgery, and the Oswestry Disability Index (ODI).

Study design

A case–control study was conducted to evaluate the correlation between factors influencing the quality of life of patients after tubular microdiscectomy.

Tubular microdiscectomy technique

All surgical procedures were performed by a single neurosurgical team using the same surgical equipment and operative technique.

The surgical intervention was performed under general anesthesia with tracheal intubation. The affected spinal level was verified intraoperatively using a C-arm fluoroscopy system Arcadis (Siemens, Germany) based on preoperative magnetic resonance imaging findings. A 2-cm skin incision was made parallel to the projection of the spinous processes. An EasyGo 2 tubular retractor system (Karl Storz, Germany) was installed. The position of the tubular retractor was confirmed using fluoroscopic control in two projections. Under the Hi-R 1000 operating microscope (HAAG-STREIT, Germany), microdiscectomy was performed using microsurgical instruments (Karl Storz, Germany) and a Primado 2 high-speed drill (NSK, Japan). The aponeurosis and dermis were sutured using Vicryl 3-0 suture material (Johnson & Johnson, USA). An aseptic dressing was applied using Steri-Strip and Tegaderm (3M, USA).

The use of the EasyGo 2 tubular retractor system (Karl Storz) reduces surgical trauma, enabling the procedure to be performed through a skin incision of up to 2 cm. Minimal injury to the osteoligamentous structures allows patient mobilization within several hours after surgery, thereby improving postoperative rehabilitation. During exposure of the neural elements, the need for coagulation is substantially reduced because muscular bleeding is absent. This technique also shortens the duration of hospital stay to one day.

The assessment of factors influencing the quality of life of patients after tubular microdiscectomy was performed with consideration of sex, height, body weight, engagement in heavy physical labor before surgery, use of nonsteroidal anti-inflammatory drugs before and after surgery, and postoperative ODI scores obtained through anonymous questionnaires.

Statistical analysis

Stepwise regression with backward elimination was used to identify the most significant variables. Records of patients who had undergone surgery within the last month before data processing were excluded because of changes in quality of life during the early postoperative period. Data from 127 patients were ultimately analyzed.

Results

Sex. Men predominated among the patients (***Fig. 1***).

Age. Most respondents were aged 30–45 years (***Fig. 2***).

Body Mass Index. The most common BMI range was 25.0–30.0 kg/m², indicating an excess body weight in the study population (***Fig. 3***).

Preoperative pharmacological therapy.

Analysis of the distribution demonstrated that the largest proportion of patients had been taking analgesic medications for 8 weeks or longer before surgery, which may indicate prolonged persistence of pain syndrome before surgical intervention (***Fig. 4***).

Duration of symptoms before surgery. The largest number of observations belonged to the "≥8 weeks" category, indicating prolonged symptom duration before surgery (***Fig. 5***).

Physical work before surgery. Most patients performed heavy physical labor before surgery (***Fig. 6***).

Postoperative pharmacological treatment. In most respondents, the duration of treatment did not exceed 1 week; however, a tendency toward prolonged medication use was observed in some patients, which may be associated with individual physiological characteristics (***Fig. 7***).

Correlation analysis of variables. The correlation heatmap demonstrates the degree of association between variables: orange indicates a negative correlation, yellow indicates a positive correlation, and white indicates the absence of correlation. Darker shading reflects a stronger association (***Fig. 8***).

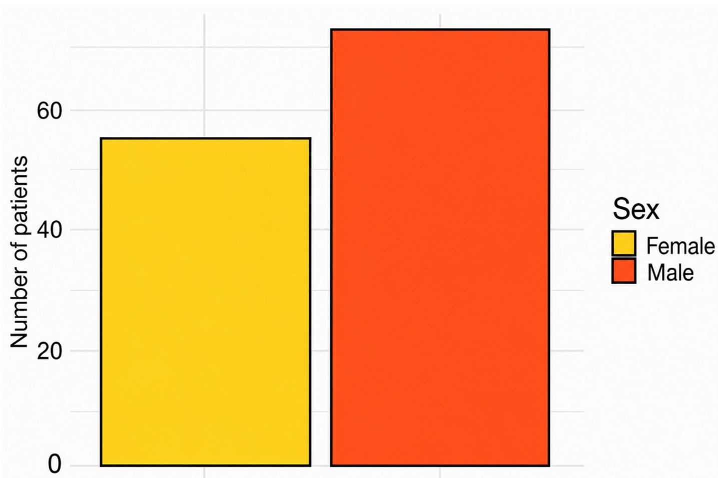

Fig. 1. Distribution of patients by sex

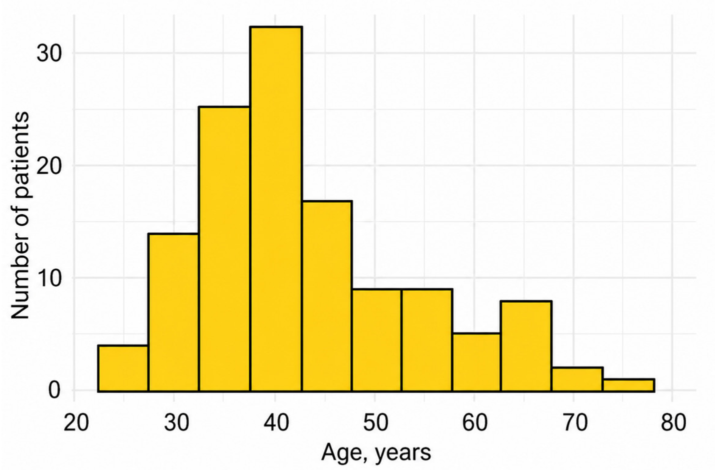

Fig. 2. Distribution of patients by age

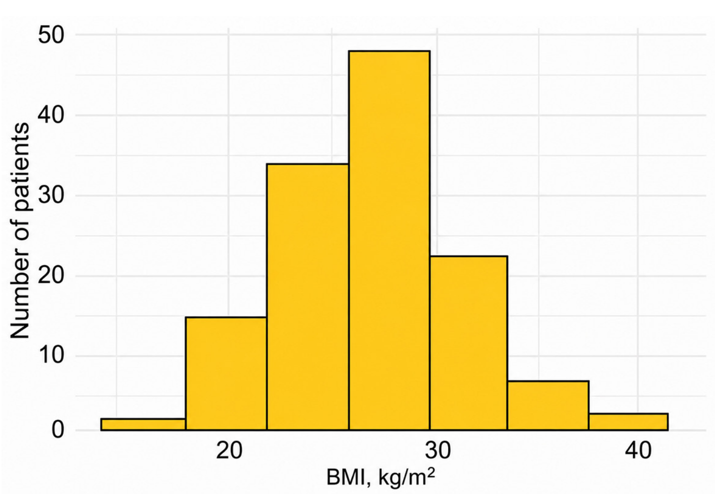

Fig. 3. Distribution of patients by BM***I***

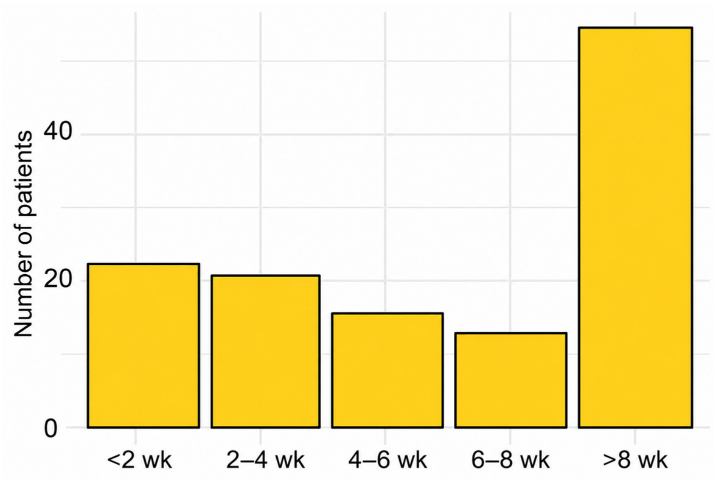

Fig. 4. Distribution of patients according to duration of medication use before surgery

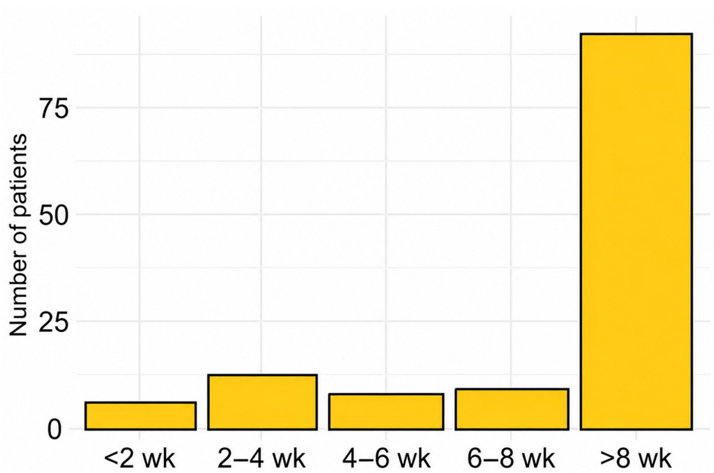

Fig. 5. Distribution of patients according to duration of symptoms before surgery

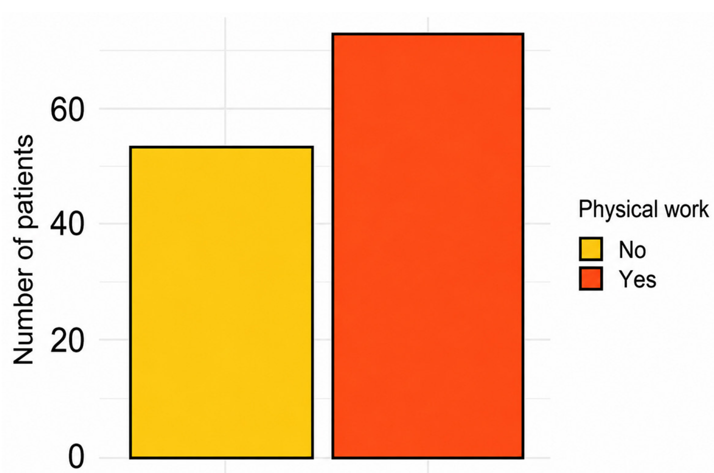

Fig. 6. Distribution of patients according to the type of physical work before surgery

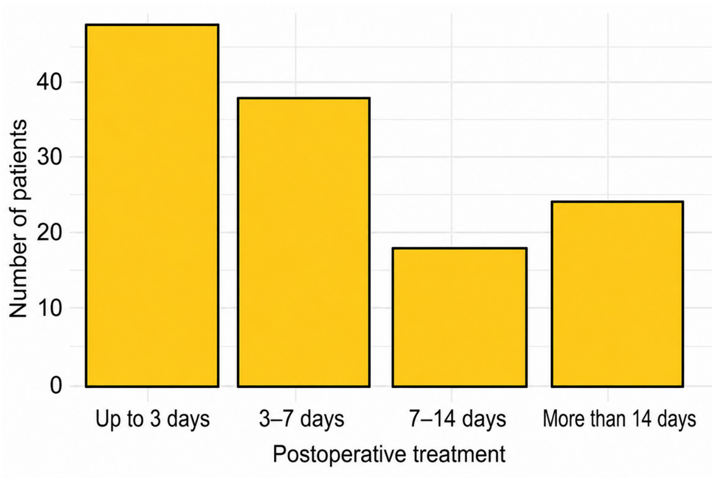

Fig. 7. Distribution of patients according to duration of postoperative pharmacological therapy

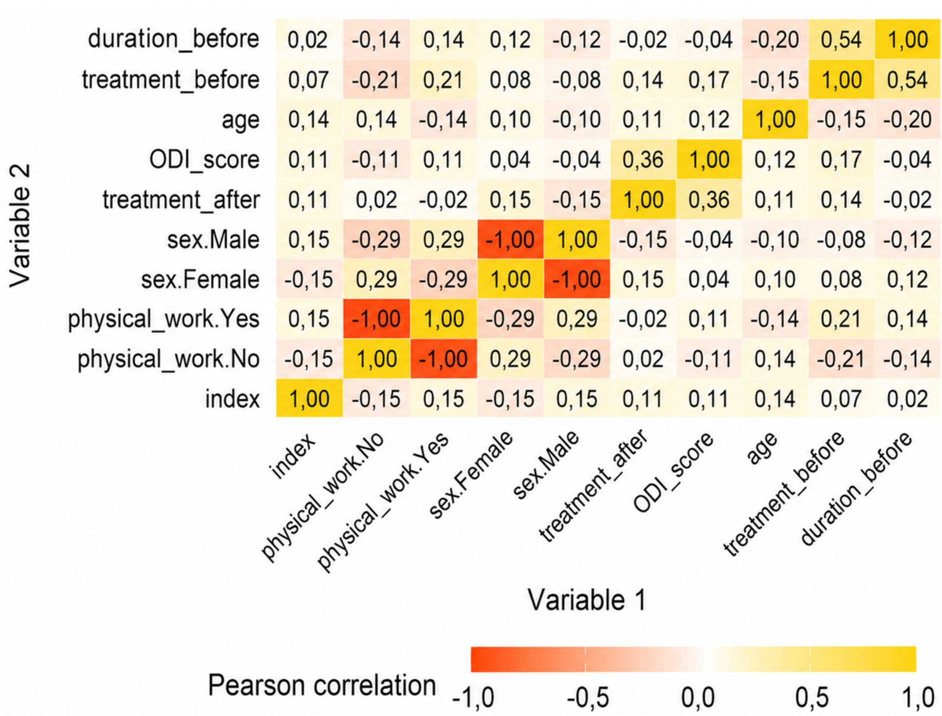

Fig. 8. Correlation between variables

For example, a complete negative correlation (–1.00) was observed between the variables "physical work: *yes*" and "physical work: *no*," which is expected because these are opposite categories of the same variable. Similarly, a strong negative correlation was identified between *male* and *female* sex, as these categories are mutually exclusive.

Other correlation coefficients on the heatmap were relatively low, which may indicate the absence of strong associations between variables in this dataset.

Backward stepwise regression analysis was used to identify the most significant variables, enabling sequential elimination of nonsignificant factors while focusing on those exerting the greatest effect on the dependent variable.

Statistical analysis revealed that the most significant factor influencing patients' postoperative health status assessment (ODI) was the variable "postoperative analgesic use." This finding is expected because patients with poorer postoperative well-being tend to require a greater amount of analgesic medication (***Table 1***).

Relationship between ODI and age. In ***Fig. 9***, yellow dots represent the well-being of individuals of the corresponding age, whereas the yellow line indicates the trend line, which appears nearly horizontal, suggesting either a weak trend or the absence of an overall tendency for changes in well-being with increasing age.

The wide dispersion of data points reflects substantial variability in well-being among individuals of the same age. The absence of a clear clustering of points along the trend line and its nearly horizontal slope indicate that the relationship between age and well-being is weak.

Relationship between ODI, age, and physical work. In Fig. 10, yellow triangles indicate individuals who performed heavy physical work before surgery ("Yes"), whereas orange dots represent those who did not perform heavy physical work ("No"). The yellow line demonstrates the trend for individuals engaged in heavy physical work before surgery, while the orange line represents those who did not perform such work. The trend lines indicate that with increasing age, the level of well-being among individuals who did not perform heavy physical work before surgery appears stable or slightly improved. In contrast, among individuals who performed heavy physical work before surgery, the relationship between age and well-being worsens, which may indicate poorer recovery in these patients or resumption of heavy physical labor after surgery.

Relationship between ODI and physical work. ***Figure 11*** compares the level of well-being (ODI) between individuals engaged in physical labor ("Yes") and those who were not ("No"). Median values were identical in both groups, indicating no substantial difference in overall well-being depending on whether an individual performed heavy physical work.

However, other characteristics of the graph provide additional information:

- for the group that did not perform physical work ("No"), the interquartile range was narrower, indicating lower ODI variability in this group;

- for the group engaged in physical work ("Yes"), the box was wider, indicating greater ODI variability;

- outliers were present in both groups, represented by individual points located at a considerable distance beyond the main data distribution. This finding indicates the presence of individuals with poor well-being markedly different from that observed in the majority of subjects within each group.

Relationship between ODI, physical work, and sex. Several conclusions can be drawn from ***Fig. 12***:

- greater variability in well-being was observed among women who performed physical work. This finding may indicate that physical labor substantially affects well-being, although the effect is heterogeneous and may vary depending on individual working conditions, health status, physical fitness, and other personal factors;

- ODI scores differed minimally between men and women who did not perform physical work, whereas among individuals engaged in physical work, the variability of ODI values was greater. Differences in well-being between men and women engaged in physical work may be explained by several factors:

1. Physiological differences: men and women have different physiological characteristics and adaptive mechanisms in response to physical нагрузка. This may influence tolerance to physical work and pain perception.

2. Psychological factors: men engaged in physical labor may have different expectations and attitudes toward well-being and pain perception. Greater habituation to physical exertion may contribute to less pronounced pain perception or a higher pain threshold.

3. Social norms and stereotypes: men may experience societal pressure to be less likely to complain of pain or discomfort, particularly in the context of physical labor traditionally associated with "male" work.

4. Working conditions and job type: men and women may perform different types of physical work that exert varying effects on well-being.

Relationship between ODI, BMI, and physical work. In ***Fig. 13****,* yellow indicates individuals who performed heavy physical work before surgery, whereas orange indicates those who did not. The trend line for individuals engaged in heavy physical work demonstrates an upward trajectory, which may indicate an increase in ODI with increasing BMI. Individuals who did not perform physical work exhibited a flatter trend, suggesting a weaker relationship between ODI and BMI. In both groups, variability in well-being scores was observed; however, increasing BMI was associated with a tendency toward poorer well-being, particularly among individuals who performed heavy physical work before surgery.

Conclusions

The quality of life of patients after tubular microdiscectomy showed only a weak association with factors such as sex, age, and engagement in physical work before surgery.

Table 1. Model results

Variable	Estimate	Standard Error	t-statistic	p-value	Statistical significance
Postoperative analgesics. L	10,863	2,533	4,289	3,59e-05	*
Postoperative analgesics. Q	2,744	2,677	1,025	0,307	
Postoperative analgesics. C	3,333	2,813	1,185	0,238	

*Note. * Significant linear association between the duration of postoperative analgesic use and ODI.*

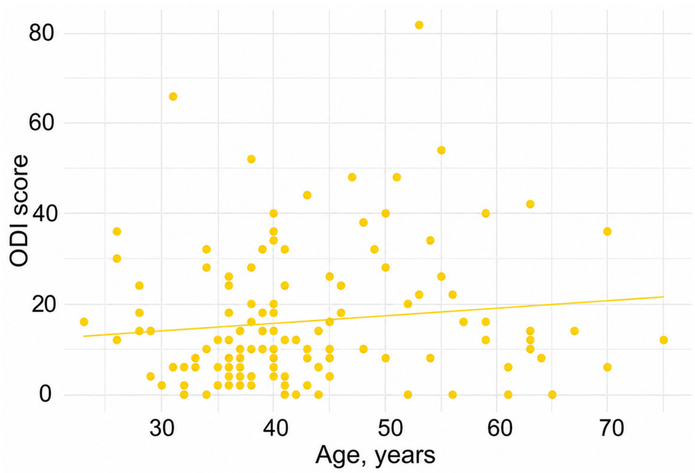

Fig. 9. Relationship between ODI and patients' age

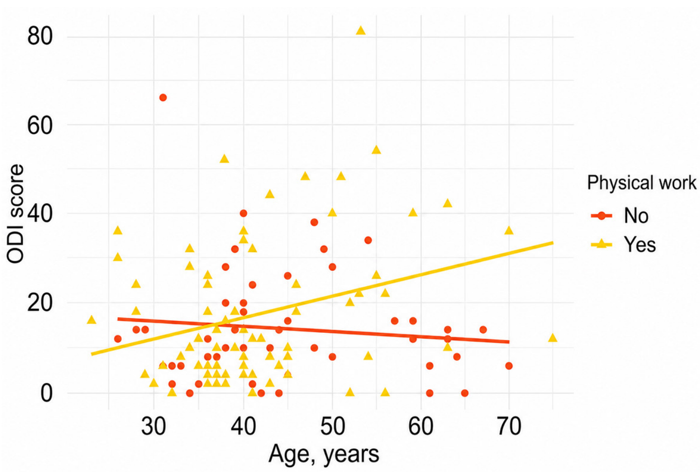

Fig. 10. Relationship between ODI, age, and physical work

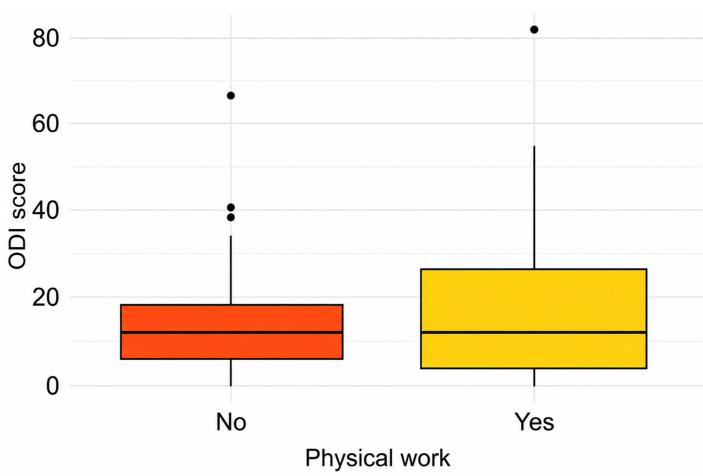

Fig. 11. Relationship between ODI and physical work

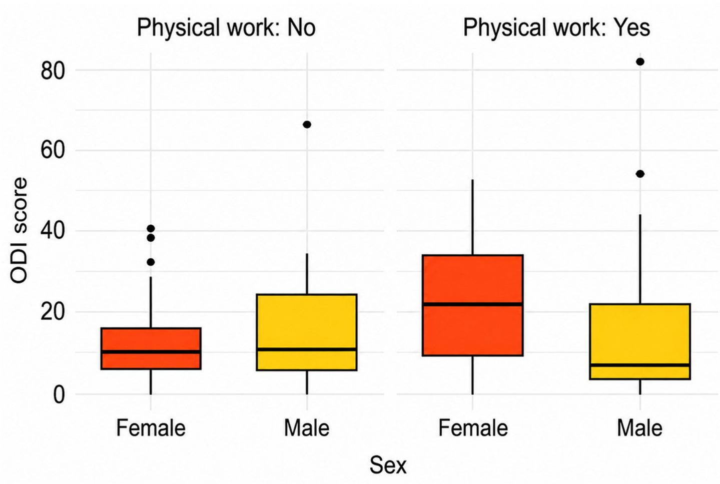

Fig. 12. Relationship between ODI, physical work, and sex

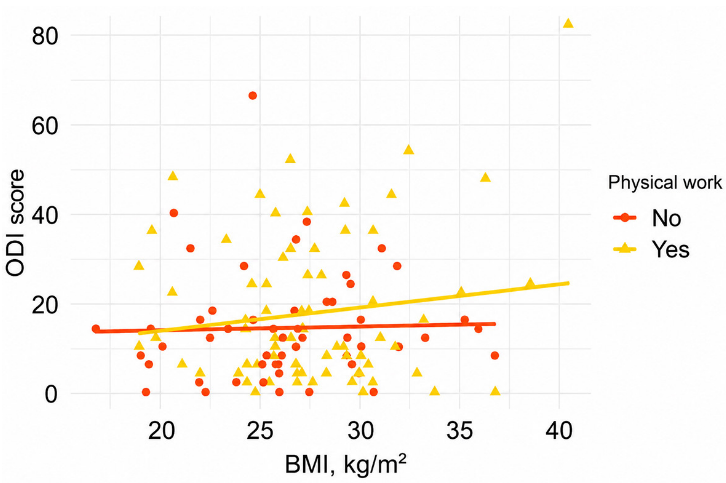

Fig. 13. Relationship between ODI, BMI, and physical work

Women who performed heavy physical work before surgery demonstrated greater variability in ODI scores compared with women who did not perform such work and with men in both groups.

The prognostic factors associated with deterioration in quality of life after tubular microdiscectomy were the combination of heavy physical work before surgery and elevated BMI. This relationship became more pronounced with increasing patient age.

Tubular microdiscectomy does not eliminate individual factors that may potentially influence postoperative well-being; however, it minimizes adverse factors during surgery and in the early postoperative period.

Further studies comparing preoperative and postoperative outcomes using different discectomy techniques are required to determine the effectiveness of tubular microdiscectomy.

Disclosure

Conflict of interest

The authors declare no conflict of interest.

Ethical standards

All procedures performed in this study involving patients complied with the ethical standards of the institutional and national research committees and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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