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## Spine Surgery Education

## Survey of postoperative practices for lumbar spinal stenosis surgery among canadian spinal surgeons and rehabilitation professionals



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## ABSTRACT

**Background:** Postoperative rehabilitation for lumbar spine stenosis (LSS) surgery has been shown to improve functional status postoperatively. However, there is a lack of clinical guidelines on postsurgical recommendations, movement restrictions and rehabilitation practices, which can lead to variations in care. The purpose of this study was to describe current postoperative LSS surgery practices of spine surgeons, physiotherapists, and chiropractors in Canada related to movement restrictions, exercise recommendations and rehabilitation.

**Methods:** The cross-sectional online survey was distributed to spine surgeons, physiotherapists and chiropractors through newsletters and emails from professional colleges and associations. The surveys involved 3 clinical vignettes of patients with LSS, each with a different type of surgical intervention. Participants were asked to reflect on the cases and provide information on their postoperative practices.

**Results:** Twenty-six spine surgeons and 151 rehabilitation professionals responded to the survey. Many of the spine surgeons in this study do not (35%) or occasionally refer (27%) their post-LSS surgery patients to outpatient postoperative rehabilitation and do not believe such programs are necessary for all patients (65.4%). There was significant variation on which restrictions should be applied and the length of time that restrictions should be used across all movements and conditions. Rehabilitation professionals observed movement restrictions that aligned with surgeons' recommendations in Cases 1 (decompression) and 3 (long fusion). However, in Case 2 (laminectomy with 1-3 level fusion), they noted more restrictions (eg, pushing, pulling, lifting) than those prescribed by surgeons. The range of exercise recommendations and treatment modalities rehabilitation professionals prescribe vary widely.

**Conclusions:** There is currently wide variation in care, demonstrating the need to build consensus among spine surgeons and rehabilitation professionals regarding the most optimal postoperative management. In addition, the reasoning behind imposed restrictions should be considered along with surgery-specific factors in refining current postoperative care pathways for the studied patient population.

## Introduction

Lumbar spinal stenosis (LSS) is associated with a narrowing of the spinal canal, resulting in high levels of back and leg pain and reduced function secondary to limited standing and walking capacity due to neurogenic claudication [1,2]. Elective surgery is recommended for those with intolerable pain and/or declining functional limitations and for

whom conservative treatment has failed [3,4]. Spine surgery prevalence is rising due to the aging population and the recognition of the need to maintain healthy aging [5]. Yet, existing scientific evidence on the effectiveness of spinal stenosis surgery demonstrates a significant variation in outcomes [6]. Success rates for LSS surgery vary between 45% and 85%, depending on factors such as the criterion by which success is measured and the follow-up period [7–16].

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Postoperative rehabilitation may improve functional status and leg/back pain after LSS surgery [8,17–21]. Research suggests that for lumbar stenosis, a postoperative supervised active exercise program can improve pain, disability, and quality of life in the short- and intermediate-term compared to usual care or advice. However, the certainty of the evidence is very low to low due to high risk of bias, small samples and inconsistency. While the evidence is promising for exercise in improving postoperative pain and disability, there is a need for more high-quality randomized controlled trials, particularly related to long-term follow-ups.

Based on the available evidence, it is not surprising that clinical guidelines lack information to support recommendations for what to include in postoperative rehabilitation programs [22–25]. There are also variations regarding movement restrictions postoperatively, with some surgeons and rehabilitation professionals recommending certain movement restrictions for varying lengths of time [26]. The significant variation in postoperative rehabilitation and movement restriction recommendations significantly impacts clinical decision-making and, ultimately, the care of patients. In addition, early fear of movement has been associated with worse outcomes postsurgery, which may be a consideration when prescribing movement restrictions [27]. Therefore, this study aims to survey Canadian spine surgeons, physiotherapists, and chiropractors to describe the current postoperative LSS surgery practices, focusing on movement restrictions, exercise recommendations and rehabilitation.

## Methods

### Study design

This study is a descriptive cross-sectional survey of post-LSS surgery rehabilitation practices of Canadian spine surgeons and rehabilitation professionals. An online survey was administered to each practitioner via Research Electronic Data Capture (REDCap) [28]. Spine surgeons were invited to participate through the Canadian Spine Society mailing list. Physiotherapists and chiropractors were invited to participate using mailing lists and newsletters from the Canadian Physiotherapy Association and the Royal College of Chiropractors. Invitations were also sent by provincial associations and colleges who agreed to distribute the survey to their members, including College of Physiotherapists of Ontario, College of Physical Therapists of BC, BC Chiropractic Association, Chiropractors' Association of Saskatchewan, New Brunswick Physiotherapy Association, New Brunswick Chiropractors' Association, and Nova Scotia College of Physiotherapists.

### Ethics

This study was approved by the Hamilton Integrated Research Ethics Board (HiREB Project# 12869). Digital consent forms were collected for all participants prior to collecting survey responses.

### Participants and recruitment

Participants were eligible if they were (1) a practicing Canadian neurosurgeon or orthopedic surgeon or (2) a registered Canadian physiotherapist or chiropractor with experience providing post-LSS surgery rehabilitation.

### Sample size

It is estimated that there are 9,000 active members of the Orthopedic Division of the Canadian Physiotherapy Association and 9,000 active members of the Canadian Chiropractic Association. There are also approximately 250 spine surgeons in Canada. For a margin of error of 10% and a 95% confidence interval, we expect to include a minimum of 100 rehabilitation professionals and 70 surgeons [29].

## Surveys

The surveys were administered using REDCap, which was licensed and stored at McMaster University. The research team developed the survey questions based on recent literature [5,26] and their current understanding of postsurgical recommendations and rehabilitation practices for post-LSS surgery. The final survey for surgeons included demographic and practice-related items, general questions about practice, and 3 case studies.

**Demographics:** Demographic and practice-related information was collected to describe the diversity and experience level of survey responders. This included information on age, sex, gender, location of practice, years of experience, patient load, and reasons as to whether they routinely refer patients to outpatient postoperative rehabilitation (surgeons only).

**Case studies:** The following 3 case studies were presented, and general practice questions were asked for each case:

**Case 1** is a 65-year-old patient with neurogenic claudication and severe canal narrowing at L4-5 who receives decompressive laminectomy.

**Case 2** is a 50-year-old patient with neurogenic claudication and severe canal narrowing at L4-5 and L3-4 who receives laminectomy with 1-3 level fusion.

**Case 3** is a 70-year-old patient with neurogenic claudication and severe canal narrowing at L4-5 and L3-4 who receives 3+ level fusion.

### General practice questions:

**Surgeons:** To control for differences in surgical approaches, we collected information on each surgeon's most common surgical approach for decompression, short fusion, and long fusion. Information was gathered on what movement restrictions were prescribed and for how long (0-6 weeks or >6 weeks). Surgeons were also asked to note any additional restrictions not listed or if there would be additional movement restrictions if the patient had osteoporosis and/or fusion to the pelvis. Further, surgeons were also asked if they routinely prescribe rehabilitation or exercise recommendations.

**Rehabilitation:** Rehabilitation professionals were asked what type of postoperative movement restrictions the patients' surgeons observed in clinical practice prescribed. We also asked about rehabilitation interventions commonly provided for each case to describe current clinical practice.

### Analysis

Results were downloaded to Microsoft Excel and analyzed using the equation function. Descriptive statistics were reported as frequencies (percentages) for dichotomous variables and mean values with 95% confidence intervals (CIs) for continuous variables. This allowed us to estimate the degree of agreement and variance in the surgeon recommendations and observed by rehabilitation providers. In addition, a chi-square test of independence was performed using STATA 17 to examine the relationship between the movement restriction prescriptions made by surgeons and those observed by rehabilitation providers. The chi-square analysis was conducted with a significance level of 0.05, but it was primarily used as an exploratory tool to provide further context to the observed patterns.

## Results

### Provider demographics

#### Surgeons

Of the 26 respondents, the mean age was 46 years (95% CI, [41.6, 50.4]), 11.5% were female, and the highest percentage workplace regions were Alberta (23.1%) and Ontario (19.2%) (Table 1). The mean

**Table 1**

Descriptive statistics of spinal surgeons.

Mean age [95% CI]	46 [41.6–50.4]	
Proportion of females (N=26)	11.5% (n=3)	
Province/Territory (N=26)	Manitoba	11.5% (n=3)
	New Brunswick	15.4% (n=4)
	Ontario	19.2% (n=5)
	British Columbia	11.5% (n=3)
	Alberta	23.1% (n=6)
	Quebec	15.4% (n=4)
	Saskatchewan	3.8% (n=1)
Mean years as a surgeon [95% CI]	15 [10.7–19.3]	
Mean # of lumbar surgeries performed/month [95% CI]	12 [9.8–14.2]	
Proportion of surgeons who provide home exercise programs (N=26)	42.3% (n=11)	
Home exercise program instructions (N=26)	Video series	0% (n=0)
	Handout	34.6% (n=9)
	Postoperative discussion with patients at discharge follow-up appointment	23.1% (n=6)
	Discharge recommendations by a nurse	7.7% (n=2)
	Discharge recommendations by a physiotherapist	34.6% (n=9)
	Discharge recommendations by a physician assistant	3.8% (n=1)
	Other	7.7% (n=2)
Proportion of surgeons who refer patients to outpatient postoperative rehabilitation (N=26)	Routinely for most patients (>75% of patients)	38.5% (n=10)
	Sometimes (~50% of patients)	26.9% (n=7)
	No - Never/Rarely (<10%)	34.6% (n=9)
Mean # of weeks post decompression recommended to seek rehabilitation [95% CI]	4.8 [4.1–5.5]	
Mean # of weeks post short or long fusion recommended to seek rehabilitation [95% CI]	7.8 [6.3–9.3]	
Reasons for not referring patients to structured rehab (N=26)	Too costly/lack of insurance	42.3% (n=11)
	I do NOT believe an outpatient postoperative rehabilitation program is needed for all patients	65.4% (n=17)
	I believe that outpatient postoperative rehabilitation may do more harm than good	3.8% (n=1)
	Other	15.4% (n=4)
Reasons that trigger a referral (N=26)	Patient wants to return to higher functional activities	65.4% (n=17)
	Patient with poor mobility function	73.1% (n=19)
	Patient with neurological deficit	46.2% (n=12)
	Patient with persistent pain	65.4% (n=17)
	Patient with reduced lumbar ROM	30.8% (n=8)
	Patient with poor exercise literacy	50% (n=13)
	Patient is deconditioned	88.5% (n=23)
	Other	15.4% (n=4)
Surgery approach for decompression (N=26)	Open	73.1% (n=19)
	Minimally invasive	46.2% (n=12)
	Other	0% (n=0)
Surgery approach for short fusion (N=26)	Open	84.6% (n=22)
	Minimally invasive	26.9% (n=7)
	Pedicle screws	76.9% (n=20)
	Instrumented fusion	69.2% (n=18)
	Posterior interbody/instrumented fusion	76.9% (n=20)
	Anterior interbody/instrumented fusion	11.5% (n=3)
	Uninstrumented fusion	0% (n=0)
	Postero-lateral fusion only	7.7% (n=2)
	Other	3.8% (n=1)
Surgery approach for long fusion (N=26)	Open	92.3% (n=24)
	Minimally invasive	3.8% (n=1)
	Pedicle screws	76.9% (n=20)
	Instrumented fusion	80.8% (n=21)
	Posterior interbody/instrumented fusion	73.1% (n=19)
	Anterior interbody/instrumented fusion	26.9% (n=7)
	Uninstrumented fusion	0% (n=0)
	Postero-lateral fusion only	7.7% (n=2)
	Other	0% (n=0)

number of years of surgical experience was 15 years (95% CI, [10.7, 19.3]). Almost half (42.3%) of the respondents provided home exercise programs, with the most common delivery methods being handouts (34.6%) and discharge recommendations by a physiotherapist (34.6%). About one-third (38.5%) of surgeons report routinely referring patients (>75% of patients) to outpatient postoperative rehabilitation, while 26.9% report referring some of the time (~50% of patients). About one-third (34.6%) of surgeons never or rarely refer their patients to outpatient postoperative rehabilitation (<10% of patients). Over half of the surgeons (65.4%) stated that they did not believe postoperative reha-

bilitation is needed for all patients, and 42.3% indicated that cost and lack of insurance were referral barriers. Most surgeons agreed that a patient being deconditioned (88.6%), having poor mobility (73.1%), persistent pain (65.4%), or desiring to return to higher functional activities (65.4%) were reasons to trigger a referral to rehabilitation.

#### Rehabilitation professionals

Of the 151 respondents, the mean age was 43 years (95% CI [41.1, 44.9]), 62.9% were female, and the highest proportion of respondents worked in Ontario (38.4%), British Columbia (22.5%), and Alberta

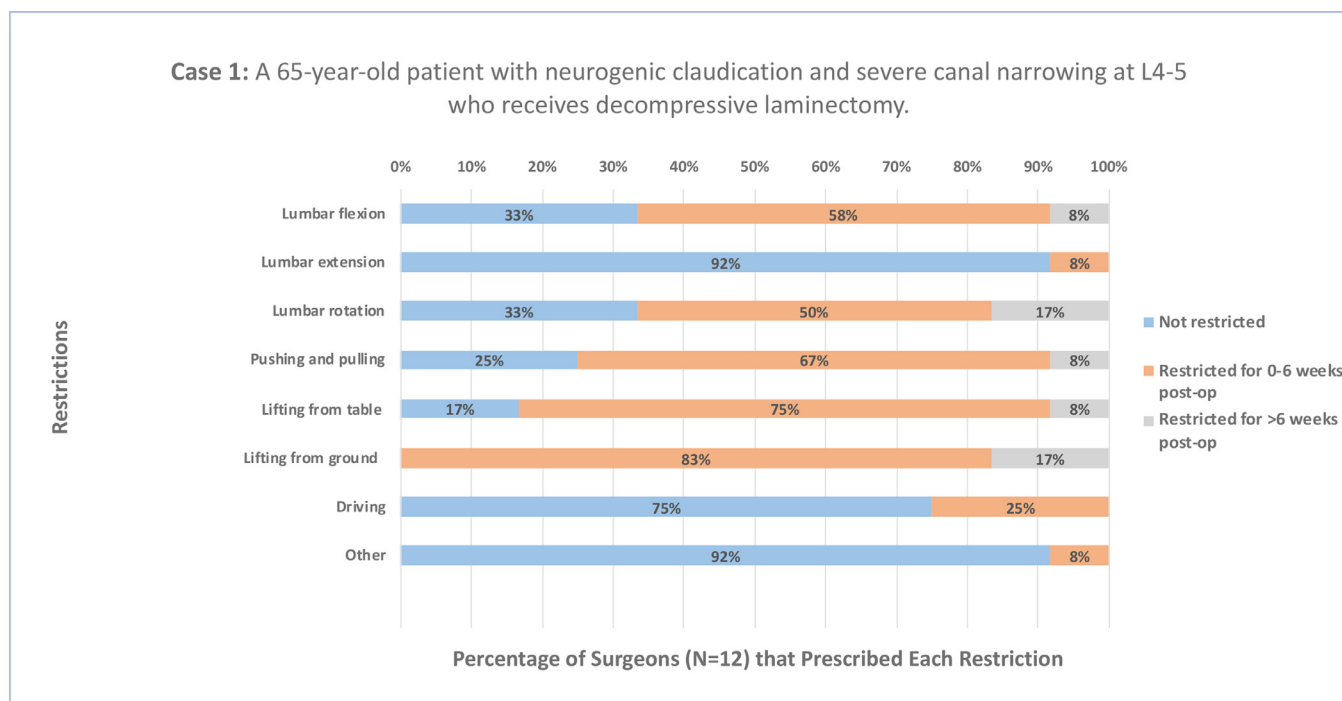


Fig. 1. Percentage of surgeons that provided postoperative movement restrictions for Case 1.

(19.9%) (Table 2). The mean number of years of treating postoperative spine patients was 14.8 years (95% CI [12.9, 16.7]), and the mean number of patients treated per month was 2.3 patients (95% CI [1.6, 3.1]). Of the 151 respondents, 88.1% were physiotherapists, and 11.9% were chiropractors. Most respondents (76.8%) worked in community outpatient clinics.

#### Case 1: Laminectomy alone

The results for Case 1 indicate no significant difference between surgeons' prescriptions and rehabilitation providers' observations,  $\chi^2(1, N=130)=0.032$ ,  $p>.05$ .

#### Surgeons

In case 1, 46.2% (n=12) of surgeons routinely prescribe movement restrictions postop (Fig. 1). Lumbar extension (92%) and driving (75%) were the least restricted movements. The most restricted movement for 0 to 6 weeks was lifting from the ground (85%) and a table (75%). In addition, 67% restricted pushing and pulling, 50% rotation and 58% flexion. Few respondents provided restrictions for more than 6 weeks postop, the most common being lifting from the ground 17%. No surgeons prescribed additional restrictions due to osteoporosis or surgeries that require fusion to the sacrum/pelvis. For case 1, 40% (n=10) of surgeons indicated that they often provide rehabilitation instructions, including range of motion (ROM), gentle core exercises, activities of daily living (ADL) as tolerated, and gentle low-impact exercises (Table 3).

#### Rehabilitation providers

In case 1, 50% (n=55) of rehabilitation professionals indicated that they routinely see patients who come to rehab with postop movement restrictions ordered by the patient's surgeon (Fig. 4). The movements with the least restrictions were lumbar extension (42%) and driving (40%). All surveyed movements were restricted by over 50% of surgeons for 0 to 6 weeks, with flexion, rotation, pushing, pulling and lifting from a table being restricted by over 65%. Further, 42% observed lifting from the ground restrictions for over 6 weeks. Only 8.3% (n=9) of respondents independently recommend long-term (>3 months) movement restrictions,

including restrictions on prolonged lumbar extension, high-impact activities, heavy lifting, and hip rotation. The most common interventions prescribed by rehabilitation professionals included core strengthening, lower extremity strengthening, pain neuroscience education, functional training, cardiovascular exercises, global stretching, and ergonomic education (Table 4).

#### Case 2: Laminectomy with 1-3 level fusion

There was a significant discrepancy between the movement restrictions that rehabilitation providers observe in practice than surgeons stated they prescribed,  $\chi^2(1, N=130)=6.85$ ,  $p<.05$ .

#### Surgeons

In case 2, 68% (n=17) of respondents routinely prescribe movement restrictions postop (Fig. 2). Similar to case 1, the least restricted movements were lumbar extension (47%) and driving (53%). However, contrary to case 1, there was a reduction in the proportion of surgeons providing no restrictions to most movements. In case 2, there was a greater proportion of surgeons limiting movement for more than 6 weeks, with the most restricted movements being lumbar flexion, rotation or lifting from the ground (35%), and 29% of surgeons providing long-term restrictions to pushing and pulling or lifting from a table. In the case of a patient with osteoporosis, only 1 respondent prescribed additional restrictions, including all movement types except driving for > 6 weeks postop. In the case of a patient who receives fusion to the sacrum/pelvis, 23.5% (n=4) of respondents prescribed additional restrictions (Supplementary Table). Three respondents further restricted lumbar flexion and rotation and lifting heavy weights from a table or the ground for >6 weeks postop. For case 2, 48% (n=12) of surgeons indicated that they often provide rehabilitation instructions, including range of motion (ROM), gentle core exercises, activities of daily living (ADL) as tolerated, and gentle low-impact exercises (Table 3).

#### Rehabilitation providers

In case 2, 71.3% (n=62) of rehabilitation professionals routinely see patients who come to rehab with postoperative movement restrictions

Table 2

Descriptive statistics of rehabilitation professionals.

Mean Age [95% CI]	43 [41.1–44.9]	
Proportion of females (N=151)	62.9% (n=95)	
Province/Territory (N=151)	Manitoba	2% (n=3)
	New Brunswick	4% (n=6)
	Ontario	38.4% (n=58)
	British Columbia	22.5% (n=34)
	Alberta	19.9% (n=30)
	Quebec	2.6% (n=4)
	Nova Scotia	2% (n=3)
	Newfoundland and Labrador	4.6% (n=7)
	Saskatchewan	4% (n=6)
Mean # of years of experience treating postoperative spine patients [95% CI]	14.8 [12.9–16.7]	
Mean # of patients treated per month [95% CI]	2.3 [1.6–3.1]	
Proportion of physiotherapists (N=151)	88.1% (n=133)	
Proportion of chiropractors (N=151)	11.9% (n=18)	
Proportion of rehabilitation professionals managing patients in acute care (N=151)	12.6% (n=19)	
Proportion of rehabilitation professionals managing patients in community outpatient clinic (N=151)	76.8% (n=116)	
Proportion of rehabilitation professionals managing patients in both acute care and community outpatient clinic (N=151)	10.6% (n=16)	
Mean Age [95% CI]	43 [41.1–44.9]	
Proportion of females (N=151)	62.9% (n=95)	
Province/Territory (N=151)	Manitoba	2% (n=3)
	New Brunswick	4% (n=6)
	Ontario	38.4% (n=58)
	British Columbia	22.5% (n=34)
	Alberta	19.9% (n=30)
	Quebec	2.6% (n=4)
	Nova Scotia	2% (n=3)
	Newfoundland and Labrador	4.6% (n=7)
	Saskatchewan	4% (n=6)
Mean # of years of experience treating postoperative spine patients [95% CI]	14.8 [12.9, 16.7]	
Mean # of patients treated per month [95% CI]	2.3 [1.6, 3.1]	
Proportion of physiotherapists (N=151)	88.1% (n=133)	
Proportion of chiropractors (N=151)	11.9% (n=18)	
Proportion of rehabilitation professionals managing patients in acute care (N=151)	12.6% (n=19)	
Proportion of rehabilitation professionals managing patients in community outpatient clinic (N=151)	76.8% (n=116)	
Proportion of rehabilitation professionals managing patients in both acute care and community outpatient clinic (N=151)	10.6% (n=16)	

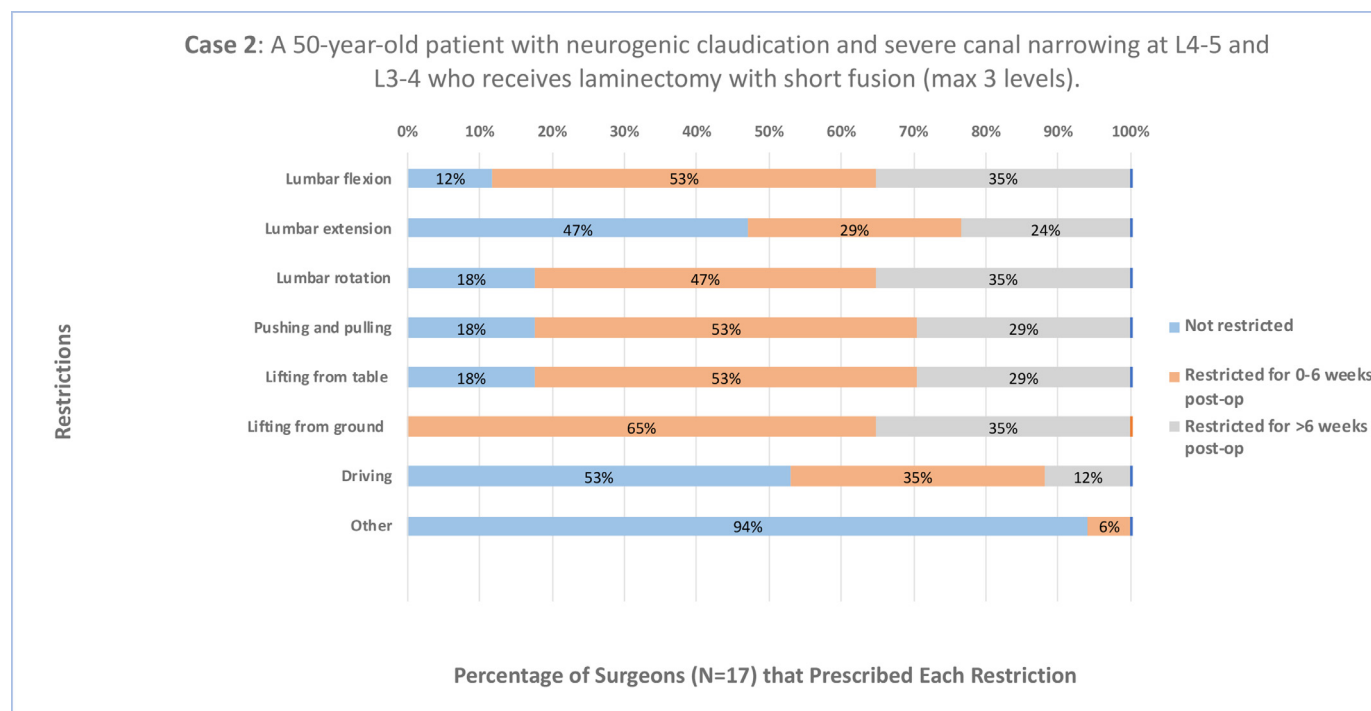


Fig. 2. Percentage of surgeons that provided postoperative movement restrictions for Case 2.

**Table 3**

Proportion of surgeons that provide rehabilitation instructions beyond referral for cases 1, 2 and 3.

	Case 1 (N=10)	Case 2 (N=12)	Case 3 (N=13)
Gentle core exercises	80% (n=8)	83.3% (n=10)	61.5% (n=8)
ADLs as tolerated	90% (n=9)	83.3% (n=10)	84.6% (n=11)
Gentle low impact exercises	60% (n=6)	58.3% (n=7)	53.8% (n=7)
Balance exercises	20% (n=2)	16.7% (n=2)	30.8% (n=4)
Back braces	10% (n=1)	5% (n=1)	7.7% (n=1)
Other	10% (n=1)	5% (n=1)	15.4% (n=2)

**Table 4**

Exercise recommendations/treatment methods rehabilitation professional prescribe to patients from cases 1, 2, and 3.

	Case 1	Case 2	Case 3
Core strengthening	48% (n=96)	39.5% (n=79)	37.5% (n=75)
Lower extremity strengthening	39% (n=78)	35% (n=70)	33.5% (n=67)
Pain neuroscience education	36% (n=72)	30% (n=60)	30.5% (n=61)
Functional training	34% (n=68)	28% (n=56)	29.5% (n=59)
Cardiovascular exercises	35.5% (n=71)	30% (n=60)	29.5% (n=59)
Global stretching	29.5% (n=59)	28.5% (n=57)	27.5% (n=55)
Ergonomic education	30% (n=60)	27% (n=54)	25% (n=50)
Upper extremity strengthening	20.5% (n=41)	20% (n=40)	21% (n=42)
Manual therapy	26% (n=52)	19% (n=38)	15.5% (n=31)
Electrotherapy	11% (n=22)	10.5% (n=21)	10.5% (n=21)
Acupuncture	8% (n=16)	7% (n=14)	7% (n=14)
Back braces	3.5% (n=7)	3.5% (n=7)	5% (n=10)
Other	4% (n=8)	4% (n=8)	2.5% (n=5)

ordered by the patient's surgeon (Fig. 5). A high proportion of rehabilitation professionals observed 0 to 6 weeks restrictions, with the highest being lifting from a table (72%), pushing and pulling (65%), flexion (65%) and driving (60%). The most restricted movement for more than 6 weeks was lifting from the ground (47%). Few respondents observed additional restrictions for patients with osteoporosis (37.1%, n=23) or for patients who received fusion to the sacrum/pelvis (7.7%, n=11) (Supplementary Table). Only 11.5% (n=10) of respondents independently recommend long-term (> 3 months) movement restrictions, including restrictions on hip rotation, lifting, lumbar flexion, and movements about the hip (Table 4). The most common interventions prescribed by rehabilitation professionals included core strengthening, lower extremity strengthening, pain neuroscience education, functional training, cardiovascular exercises, global stretching, and ergonomic education (Table 4).

#### Case 3: 3+ Level fusion

There was no significant discrepancy between the movement restriction prescriptions made by surgeons and what rehabilitation providers observed,  $\chi^2(1, N=106)=0.11$ ,  $p>.05$ .

#### Surgeons

In case 3, 72% (n=18) of respondents routinely prescribe movement restrictions postop (Fig. 3). The movement with the least restriction was lumbar extension (39%), followed by lifting from a table or driving (22%). In contrast, restrictions of greater than 6 weeks were higher than in the previous cases, with the most restricted movements being lifting from the ground (44%), lumbar flexion, rotation or lifting from a table by 39% of surgeons. Two respondents prescribed additional restrictions if osteoporosis is present, and 3 if fusion to the sacrum/pelvis was needed. (Supplementary Table). For case 3, 52% (n=13) of surgeons indicated that they often provide rehabilitation instructions, including the range of motion (ROM), gentle core exercises, activities of daily living (ADL) as tolerated, and gentle low-impact exercises (Table 3).

#### Rehabilitation providers

In case 3, 75.3% (n=61) of rehabilitation professionals routinely see patients who come to rehab with postoperative movement restrictions

ordered by the patient's surgeon (Fig. 6). The most restricted movements for up to 6 weeks were driving 67%, lifting from a table 62%) and pushing and pulling (57%). There were also many observed restrictions for over 6 weeks, including lifting from the ground (59%), rotation (46%), flexion and extension at 44%. Few respondents observed additional restrictions for patients with osteoporosis (27.9%, n=17) or patients who received fusion to the sacrum/pelvis (14.8%, n=9). Only 19.8% (n=16) of respondents independently recommend long-term (>3 months) movement restrictions, including restrictions on hip rotation, high-impact activities, lumbar flexion, extension, and heavy lifting. The most common interventions prescribed by rehabilitation professionals included core strengthening, lower extremity strengthening, pain neuroscience education, functional training, cardiovascular exercises, global stretching, and ergonomic education (Table 4).

#### Discussion

This study aimed to investigate the variation in postop management for LSS surgery amongst spine surgeons, physiotherapists, and chiropractors. The survey results suggested that many of the surgeons who responded did not see outpatient postoperative rehabilitation as necessary for all patients. Some mentioned that they rarely or never refer patients to such rehabilitation, while others noted that they occasionally make referrals. However, specific reasons that surgeons state may warrant a referral to rehabilitation, such as when a patient is experiencing poor mobility, persistent pain, or wanting to return to higher functional activities. Overall, surgeons had minimal consensus on which restrictions should be applied for individuals after surgery. This finding is similar to previous literature that suggests a significant amount of inconsistency and variation in patient management for individuals undergoing spine surgery [30,31].

Despite the general nonconsensus, some agreement was noted in 2 areas: (1) when it comes to patients with osteoporosis or receiving fusion to the sacrum/pelvis, most surgeons stated that further movement restrictions beyond what was already prescribed are not necessary, and (2) when movement restrictions were applied, they were often for less than 6 weeks with longer-term restriction for more complex cases. For laminectomy alone, many movements were not restricted, with the great majority of restrictions being for up to 6 weeks. For more complex surgeries (laminectomy with 1–3 level fusion or 3+ level fusion), a greater proportion of surgeons prescribe restrictions across all movements for greater than 6 weeks postoperatively. Given that long-term movement restrictions have been found to delay patients' return to work in other types of spine surgeries [32], gathering information on the rationale for applying long-term vs short-term movement restrictions would be important in future research.

The number and length of movement restrictions observed by rehabilitation professionals correspond with the recommendations given by surgeons in cases 1 (laminectomy) and 3 (3+ level fusion). However, in Case 2 (laminectomy with 1–3 level fusion), rehabilitation providers observed more restrictions (eg. pushing, pulling, lifting, etc.) than surgeons stated they prescribed. If rehabilitation providers observe more restrictions, it raises the possibility that more cautious surgeons may be more likely to refer patients to rehabilitation providers or that patients who perceive greater limitations may be more likely to seek rehabilitation. This case highlights the middle ground on the current spectrum of case complexity. Thus, while postoperative management may be clearer at the end of the spectrum (case 1 and 3), patient undergoing laminectomy with 1–3 level fusion remain a critically important area of further investigation. While Case 3 also involved fusion, its greater complexity (multilevel fusion) might have led to more standardized recommendations across providers. The pattern follows that the more involved procedures have more postop movement restrictions prescribed and that further restrictions for a patient with osteoporosis or who received fusion to the sacrum/pelvis were infrequent. Rehabilitation providers noted that exercise and treatment recommendations depend on multiple fac-

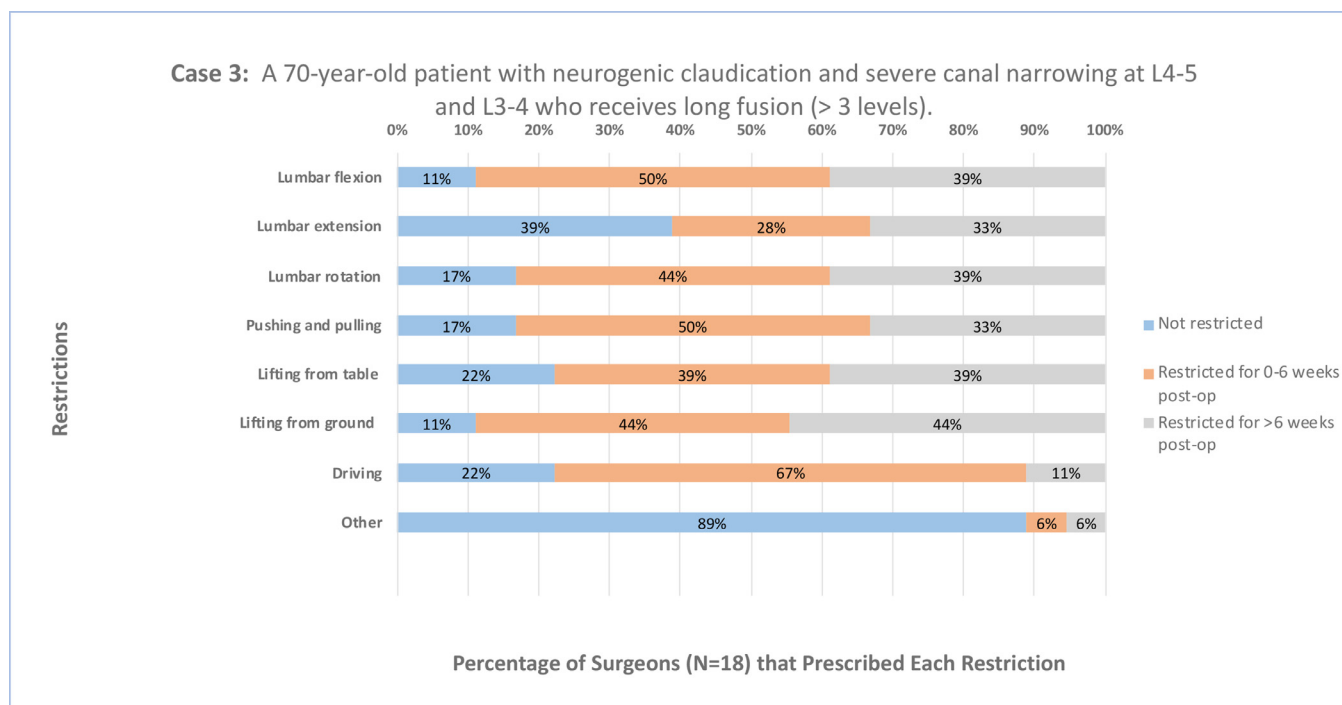


Fig. 3. Percentage of surgeons that provided postoperative movement restrictions for Case 3.

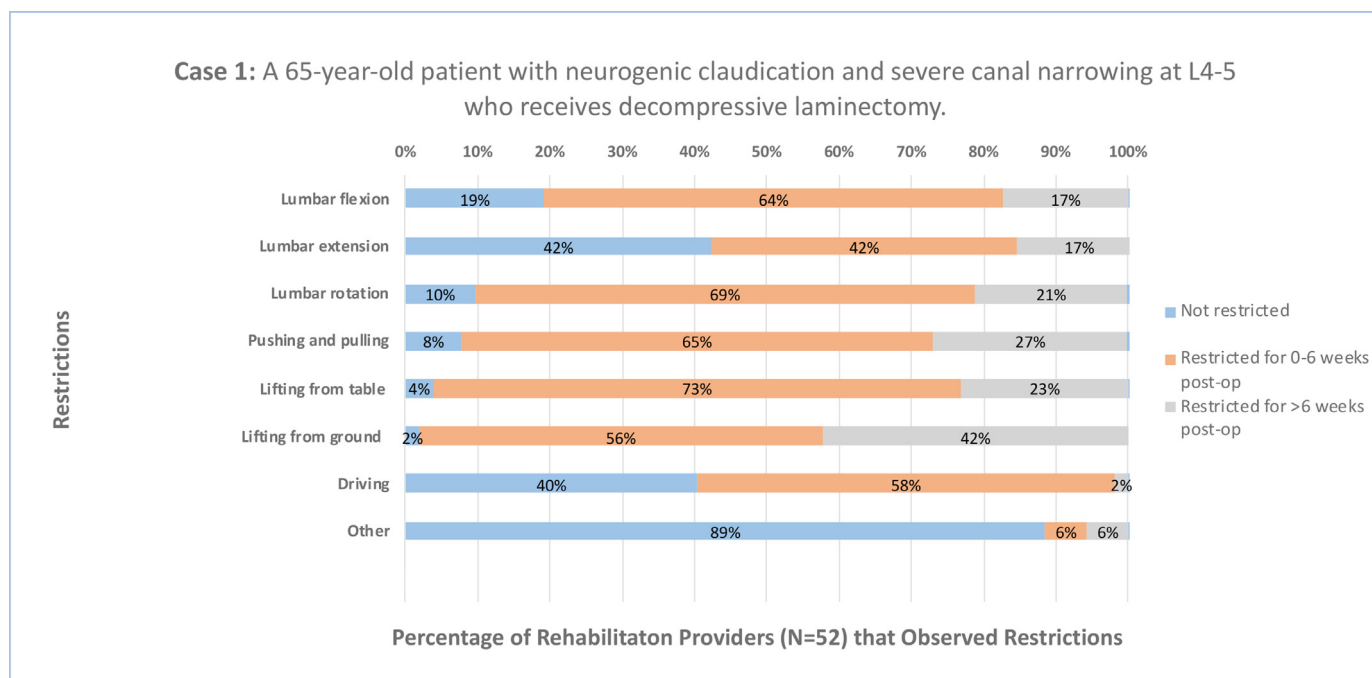
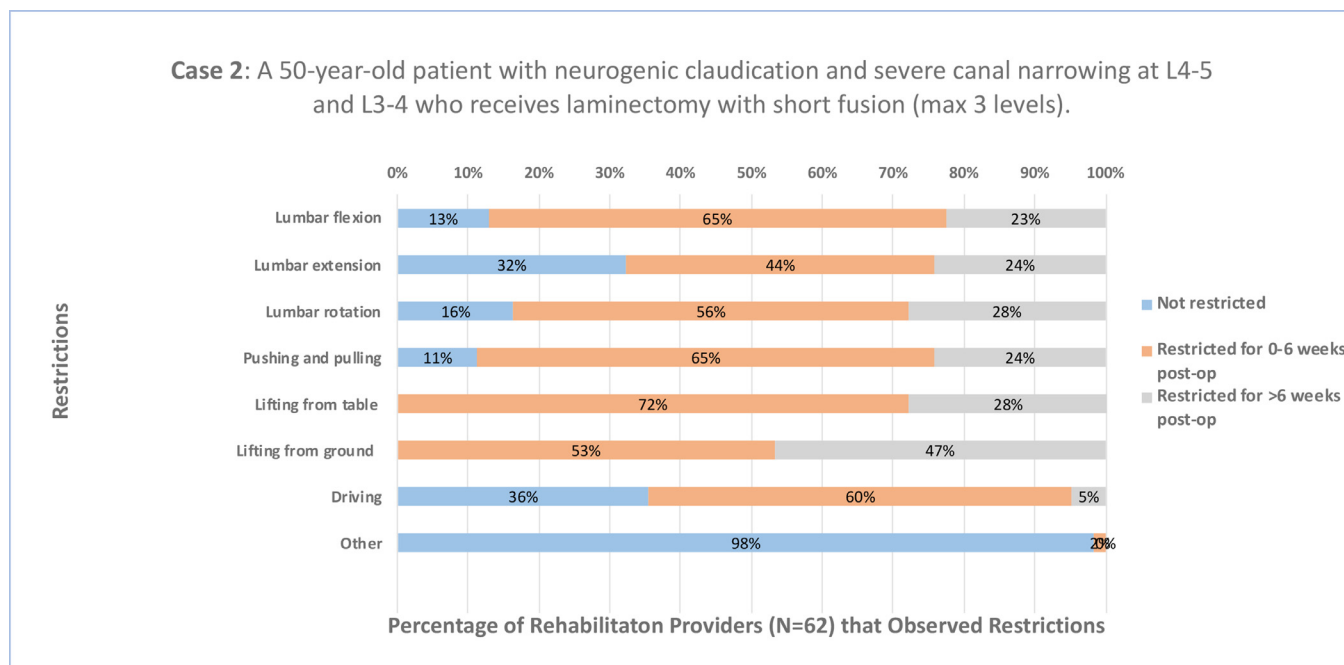


Fig. 4. Percentage of rehabilitation providers that routinely see patients who come to rehab with postop movement restrictions ordered by the patients' surgeon for case 1.

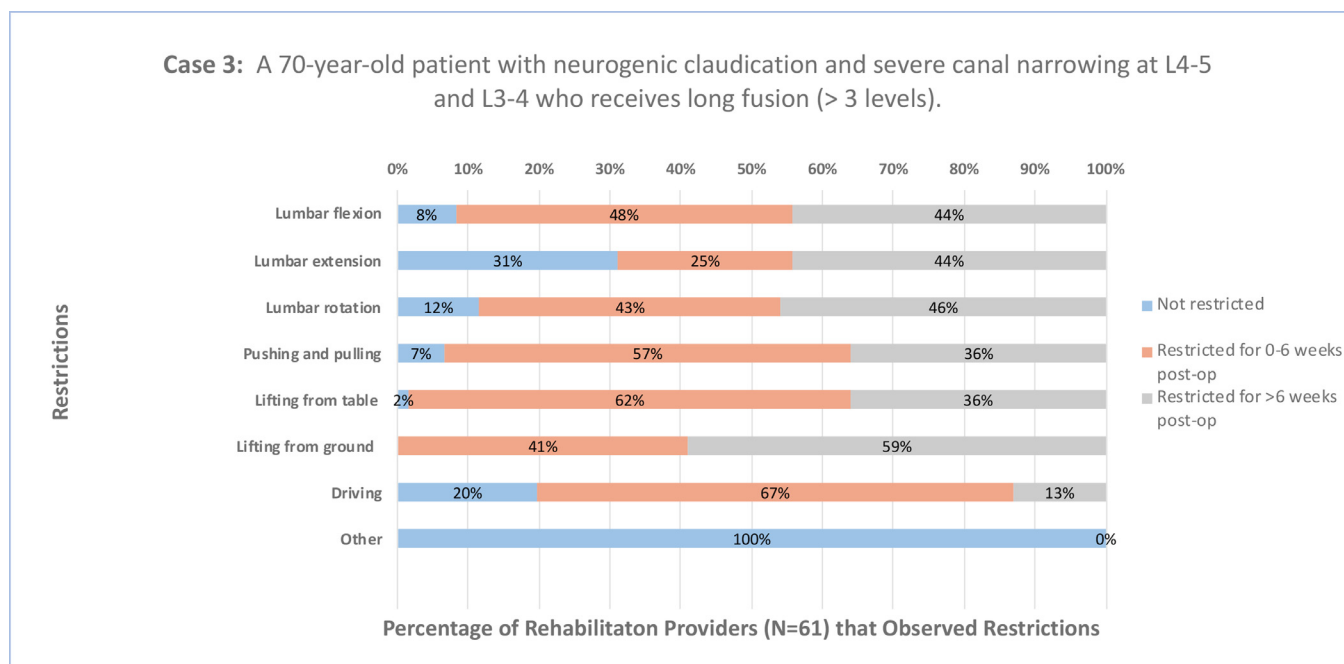
tors, including age, how a patient handled the surgery, whether there were complications such as infection, and the patient's goals for returning to work/daily activities. Thus, creating a set guideline for rehabilitation exercise prescription may be challenging, but it is important to test within a pragmatic clinical trial. Future research should aim to develop a protocol-based rehabilitation approach for each type of lumbar surgery.

Several reviews suggest the effectiveness of rehabilitation following lumbar spine surgery [17–20,33], and a recently published longitudinal

cohort study, including adults undergoing spinal surgeries for degenerative conditions, recommends that all healthcare providers encourage patients to exercise pre- and postoperatively [34]. Regardless of the case presented in our study, few surgeons state that they provide specific rehabilitation guidelines on exercise beyond referral to rehabilitation. Due to the potential for patients to face barriers in seeking outpatient postoperative rehabilitation (eg, cost associated with treatment), surgeons should educate patients on appropriate postoperative exercise upon discharge. The wide variation in care highlights the importance of address-



**Fig. 5.** Percentage of rehabilitation providers that routinely see patients who come to rehab with postop movement restrictions ordered by the patients' surgeon for case 2.



**Fig. 6.** Percentage of rehabilitation providers that routinely see patients who come to rehab with postop movement restrictions ordered by the patients' surgeon for case 3.

ing healthcare access inequities when collaborating across disciplines in postoperative care pathways.

The findings of this study are similar to those of previous research conducted in the United Kingdom [35]. This study found considerable variability in postoperative management of spine surgery, including protocols, hospital stay duration, discharge criteria, and follow-up practices. However, in contrast to the findings from our study, there appeared to be more consensus on emphasizing the importance of postoperative physiotherapy [35]. These results highlight the variability among prescriptions of postoperative rehabilitation and movement re-

strictions and the need to develop a consensus or standardized approach to managing lumbar spine surgery.

**Strengths and Limitations:** The strengths of this study include the development of the survey questions in consultation with spinal surgeons and physiotherapists who are experienced in treating this patient population. To capture a wide range of responses from across Canada, the research team contacted colleges and associations in all provinces to promote this study. A limitation of our study is the sample size—although we received 151 responses from rehabilitation professionals, we only received 26 responses from surgeons. This resulted in some survey items

having less than an optimal number of responses, as such the surgeons' responses should be interpreted cautiously, given the lack of generalizability.

## Conclusion

Outpatient rehabilitation referrals were not consistently endorsed by all surgeon respondents, and there was little agreement on the specific movement restrictions or their duration across various conditions. This lack of consensus highlights the need for collaboration between spine surgeons and rehabilitation professionals to establish clear, evidence-based guidelines for movement restrictions and exercise recommendations for postoperative patients.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.xnsj.2025.100600](https://doi.org/10.1016/j.xnsj.2025.100600).

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