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Postoperative Brace Prescription Practices for Elective Lumbar Spine Surgery: A Questionnaire-Based Study of Spine Surgeons in Japan

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ABSTRACT

Introduction: The efficacy of postoperative braces for degenerative lumbar disorders has long been debated, with conflicting reports regarding the promotion of bone fusion and pain relief. The current aspects of postoperative brace prescriptions have been previously reported in Western countries but not in Asia. This study aimed to elucidate prescription practices in Japan and identify factors influencing prescription decisions.

Materials and Methods: The survey was conducted at a spine group research meeting comprising spine surgeons from multiple institutions. The questionnaire assessed aspects of postoperative brace prescription, including the type, purpose, and duration of usage, categorized by surgical procedures for degenerative lumbar disorders: endoscopic decompression, open surgery decompression, and fusion involving 1 or more than 3 levels. The respondents' backgrounds, scientific knowledge of postoperative braces, nonscientific reasons, and basis for prescription decisions were also investigated.

Results: There were 63 valid responses. The overall postoperative brace prescription rate was 83%, with 66% for decompression and 98% for fusion procedures, surpassing the rates reported in Western studies. The primary prescription purpose was to slow down patient activity (83%, double the previously reported rates). Prescription rates for endoscopic and open surgical decompression were significantly correlated with facility attributes and annual number of surgeries. Scientific knowledge of postoperative braces was lacking in 56% of respondents, with scientific evidence being the least frequent decision for brace prescription (14%). Nonscientific reasons influenced the prescription decisions of 84% of participants.

Conclusion: The postoperative brace prescription rate among spine surgeons in Japan was significantly higher than that in Western studies, largely due to nonscientific factors such as physician reassurance and the intention to slow down patient activity. Comprehensive, evidence-based guidelines are needed regarding consistent brace usage to optimize patient outcomes.

Clinical Relevance: This study highlights the high postoperative brace prescription rates among spine surgeons in Japan, which are significantly influenced by nonscientific factors, such as tradition, physician reassurance, and patient satisfaction, rather than scientific evidence. These findings underscore the need for evidence-based guidelines to improve consistency in postoperative brace usage. The results are particularly relevant in regions with aging populations and a high prevalence of osteoporosis, providing insights for improving postoperative management strategies and patient outcomes in Japan as well as in similar demographic settings globally.

Level of Evidence: 4.

Lumbar Spine

Keywords: brace, postoperative management, orthosis, surveillance, lumbar spine

INTRODUCTION

The use of postoperative braces to treat degenerative lumbar disorders has long been debated.[1] Previous reports have suggested that braces can reduce gross body motion in the lumbar spine.[2,3] However, some reports, including randomized controlled trials, contradict the effects of promoting bone fusion, pain relief, and functional improvement.[4–9] The current aspects of postoperative brace prescriptions require reevaluation. Prescription rates in Western countries have been reported (38% in Belgium[10] and 49% in the United States)[11,12] and show a decreasing trend of 26% over 10 years.[12] A cross-sectional international survey on postoperative bracing indicated that the prescription rate

varied according to geographic regions.[13] However, research on this topic in Asia is lacking, and the factors influencing the prescription of postoperative braces remain unclear. This study aimed to elucidate postoperative brace prescription practices in Japan, investigate the factors involved, and determine whether these prescriptions are based on scientific knowledge and evidence.

MATERIALS AND METHODS

Ethical Considerations

The study design was approved by the appropriate Ethics Review Board. The participants of the survey were informed that their responses would constitute consent to participate in the study.

Study Design

This study included spine surgeons from hospitals in the Kanto region, the most populous area of Japan, with broad representation of spine surgery practices. The questionnaire was distributed and collected during a research meeting in January 2023, referencing and modifying previous reports (see Supplemental file for the original questionnaire).[10,12] The respondents' background information included department affiliation, facility attributes, annual number of spine surgeries, age, history of spine surgery, and position within the spinal surgery team.

To investigate prescription practices, surgical procedures for lumbar degenerative disorders were categorized into endoscopic decompression, open surgical decompression, 1-level fusion, and ≥3-level fusion. Average endoscopic and open surgical decompressions were noted as decompression procedures, and 1- and ≥3-level fusions were noted as fusion procedures. (Of note, fusions were categorized into 1-level and ≥3-level procedures to enable a focused comparison between short-segment and long-segment fusion/decompression practices, resulting in the exclusion of 2-level fusions.) For each procedure, if the surgery was performed regularly, the respondents were asked about the presence of postoperative brace prescriptions. If prescribed, further questions included the type of brace, purpose of prescription, duration of usage, and potential impact on future medical practice due to situational changes.

Braces

Respondents could chose 1 of 3 brace types: lumbar support belt (rubber or elastic band), soft corset (fabric or mesh material), or rigid orthosis (plastic or metal material). Regarding the purpose of the brace prescription, respondents could chose all that applied from the following 4 options: promote bone fusion, pain relief, and wound protection, or slow down excessive activity. Respondents were also asked to indicate the duration of brace usage using one of the following options: <3 weeks, 3–8 weeks, 2–4 months, or ≥4 months.

Impact of Situational Changes on Future Practices

Respondents were asked about the potential impact on future prescriptions if their department head or guidelines explicitly stated that postoperative braces for bone fusion or pain relief should not be prescribed. The following 2 options were available: it will affect future medical care (changes in brace prescription indications) or it will not have any effect.

Three additional survey items were posed to all respondents, regardless of whether they performed specific procedures: (1) possession of scientific knowledge regarding the usefulness of postoperative braces, (2) nonscientific reasons for brace prescription, and (3) basis for deciding the indications for brace prescription.

1. **Possession of scientific knowledge.** Respondents could chose 1 of the following 4 options: positive knowledge, negative knowledge, both positive and negative knowledge, or no knowledge.
2. **Nonscientific reasons.** Respondents could chose all that applied from the following 4 options: reassuring the doctor (ie, themself), reassuring the patient, adhering to traditions or customs, or contributing to hospital revenue.
3. **Basis for deciding the indications.** Respondents could chose 1 of 3 options: scientific evidence, personal experience, or recommendations from colleagues or superiors.

Statistical Analysis

Statistical analyses were performed using JMP Pro 17.2.0 (SAS Institute Inc., Cary, NC, USA), and the significance level was set at $P < 0.05$. For bivariate analysis, we performed Fisher's exact test. For multivariate analysis, we conducted nominal logistic regression analysis.

RESULTS

Valid responses were obtained from 63 of 69 participants. Respondents' characteristics are listed in the Table. All respondents were from the orthopedic surgery

Table. Characteristics of respondents who returned valid questionnaires (*N* = 63).

Characteristics	*N*	%
Specialty		
Orthopedic surgery	63	100
Neurosurgery	0	0
Age, y		
<30	10	16
30–39	23	36
40–49	20	32
50–59	8	13
>60	2	3
Spine surgery experience, y		
No regular surgery	9	14
<5	12	19
5–10	16	26
10–20	19	30
>20	7	11
Annual number of spine surgeries		
<20	11	18
20–50	11	18
50–80	10	16
>80	31	49
Position		
Training in progress	32	51
Attending surgeon	17	27
Chief/director	14	22
Facility		
University hospital	15	24
Public hospital	30	48
Private general hospital	16	25
Private spine hospital	2	3

department. The respondents' facilities included public hospitals (48%), private general hospitals (25%), university hospitals (24%), and private specialized spinal hospitals (3%). Approximately half of respondents reported performing >80 spinal surgeries annually. The postoperative brace prescription rates for each surgical procedure and their average values are shown in Figure 1. The overall brace prescription rate in this study was 83%. Specifically, the rates were 66% and 98% for decompression and fusion procedures, respectively, with the fusion procedure rate being significantly higher than that of the decompression procedure rate ($P < 0.0001$). Furthermore, the prescription rate for endoscopic decompression was at 57%, compared with 71% for open surgery decompression, although this difference was not significant ($P = 0.1905$).

Multivariate analysis on prescription rates and respondent backgrounds revealed significant correlations between prescription rates for endoscopic ($P = 0.0039$) and open surgical decompression ($P = 0.0089$) with facility attributes, as well as with the annual number of surgeries for both endoscopic ($P = 0.0318$) and open surgical decompression ($P = 0.0416$). Namely, facilities with higher annual surgeries prescribed braces more frequently, whereas university hospitals had lower

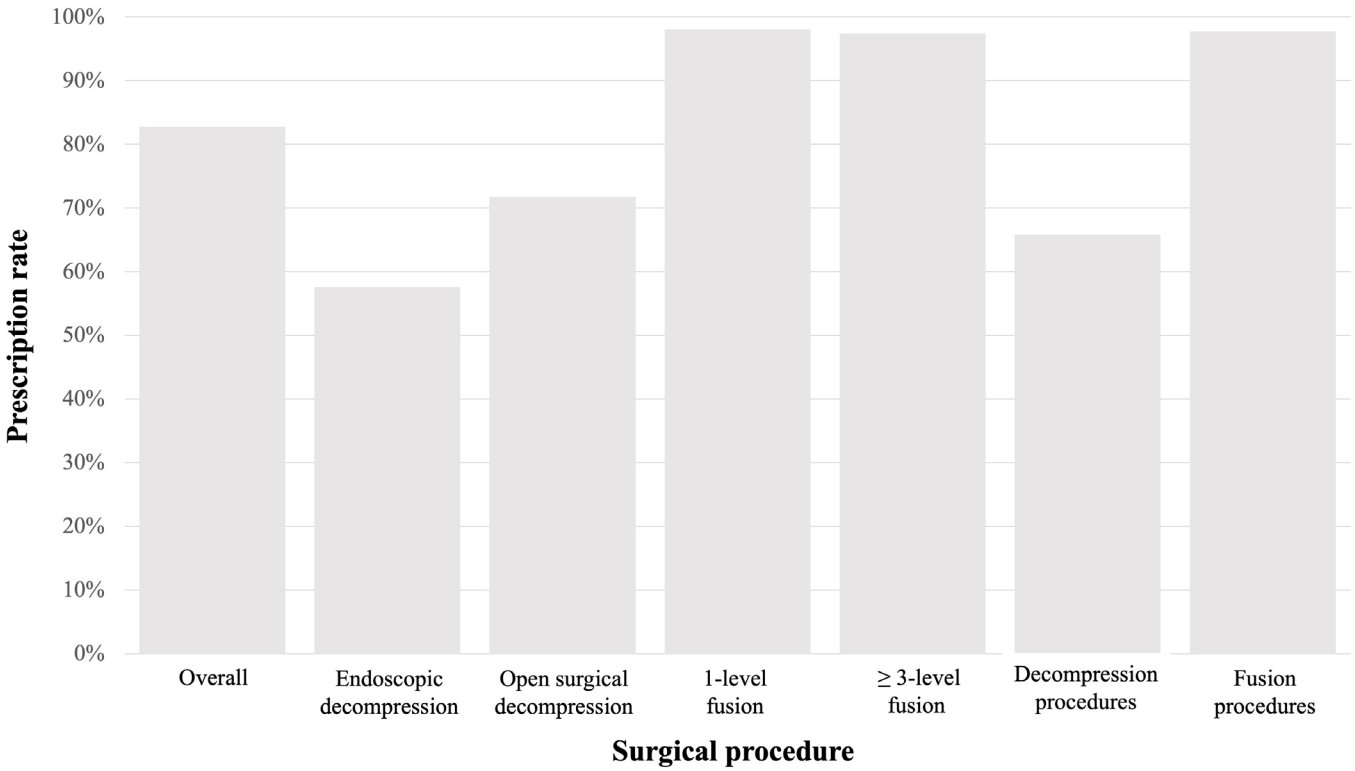

Figure 1. Postoperative brace prescription rates for each surgical procedure. Responses regarding brace prescriptions were obtained from respondents who regularly performed these surgical procedures. Overall represents the combined average value of the rates of endoscopic decompression, open surgical decompression, 1-level fusion, and ≥3-level fusion. Decompression procedures represent the combined average value of the rates of endoscopic and open surgical decompression, and fusion procedures represent the combined average value of the rates of 1- and ≥3-level fusions.

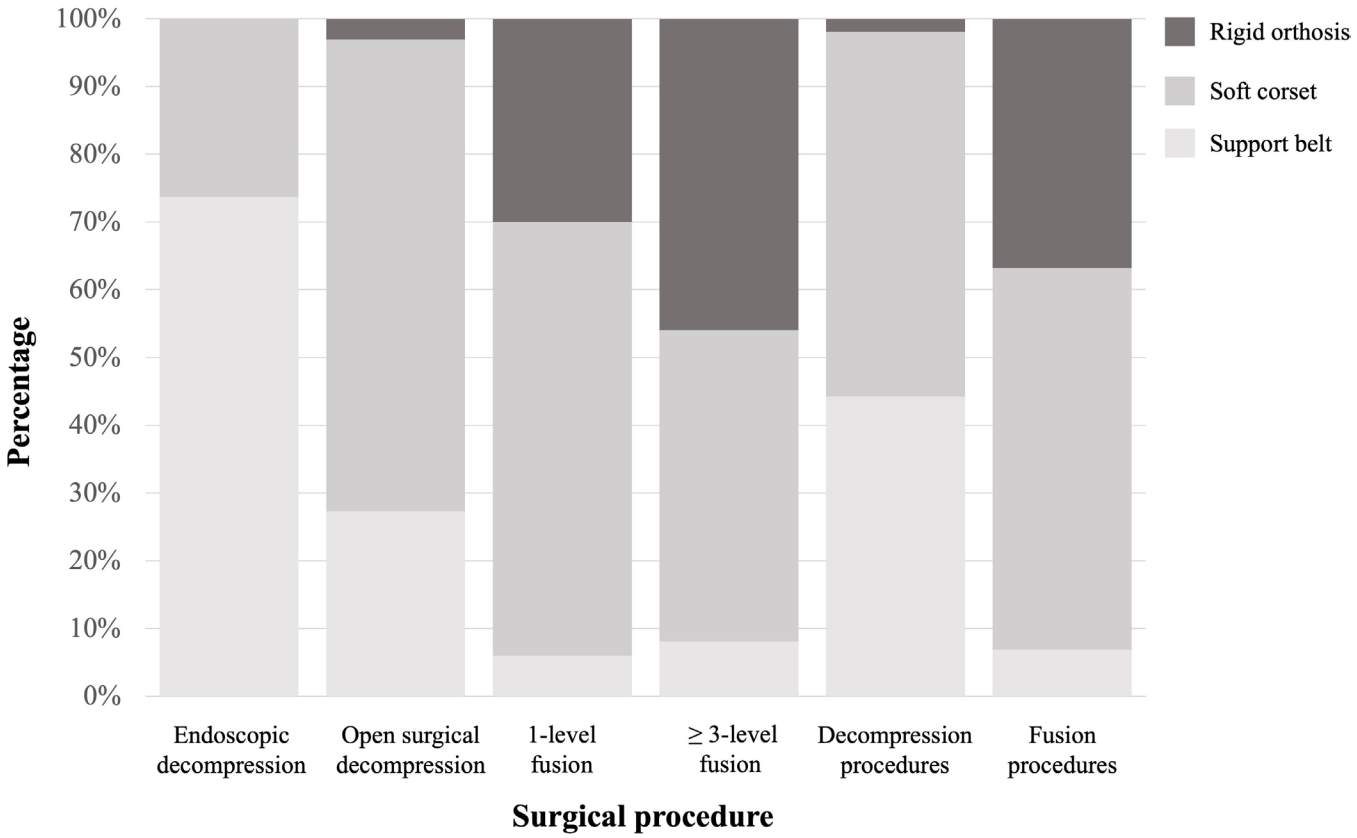

Figure 2. Types of braces prescribed for each surgical procedure. Responses were obtained from respondents who regularly performed these surgical procedures, prescribed a brace, and selected 1 of the 3 brace types. A support belt is made of rubber or an elastic band, a soft corset is made of fabric or mesh material, and a rigid orthosis is made of plastic or metal material.

prescription rates compared with other hospitals. No significant differences in fusion procedures were found based on respondent backgrounds, possibly due to the uniformly high prescription rates.

The types of braces used for each surgical procedure and each decompression and fusion procedure are shown in Figure 2. Support belts accounted for 44% of decompression procedures, which was significantly higher than that for fusion procedures (6%; $P < 0.0001$). Rigid orthoses accounted for 33% of fusion procedures, which were significantly higher than that for decompression procedures (2%; $P < 0.0001$). However, among the fusion procedures, there was no significant difference between rigid orthoses for 1- (30%) and ≥3-level (46%) fusions ($P = 0.0970$). Thus, support belts were frequently prescribed in decompression procedures, whereas rigid orthoses were frequently prescribed in fusion procedures, regardless of the number of fusion levels.

Overall, the most common prescription purpose was to slowdown patient activity (83%), followed by pain relief (55%), wound protection (50%), and bone fusion (34%; Figure 3). Analysis of each procedure individually revealed that activity slowdown was the most common purpose, followed by pain relief, across all procedures.

The duration of brace use for each surgical procedure is shown in Figure 4. In both endoscopic and open surgical decompression procedures, more than half of the patients responded with <8 weeks. For 1- and ≥3-level fusion procedures, >90% of patients responded with >2 months. The fusion procedure had a significantly higher proportion of prescriptions for long-term usage (>2 months) than the decompression procedure (94% vs 38%; $P < 0.0001$). Endoscopic decompression had a higher proportion of short-term usage (<8 weeks) compared with open surgical decompression (73% vs 54%), although this difference was not statistically significant ($P = 0.1719$).

If the department head of respondents and guidelines explicitly declared "postoperative braces are not necessary for bone fusion or pain relief purposes," approximately 53% and 58% of respondents, respectively, on average across all procedures believed it would affect future brace prescription. In other words, more than half indicated a potential reduction in brace prescriptions.

Regarding the utility of postoperative braces, 56% of respondents claimed that they had no scientific

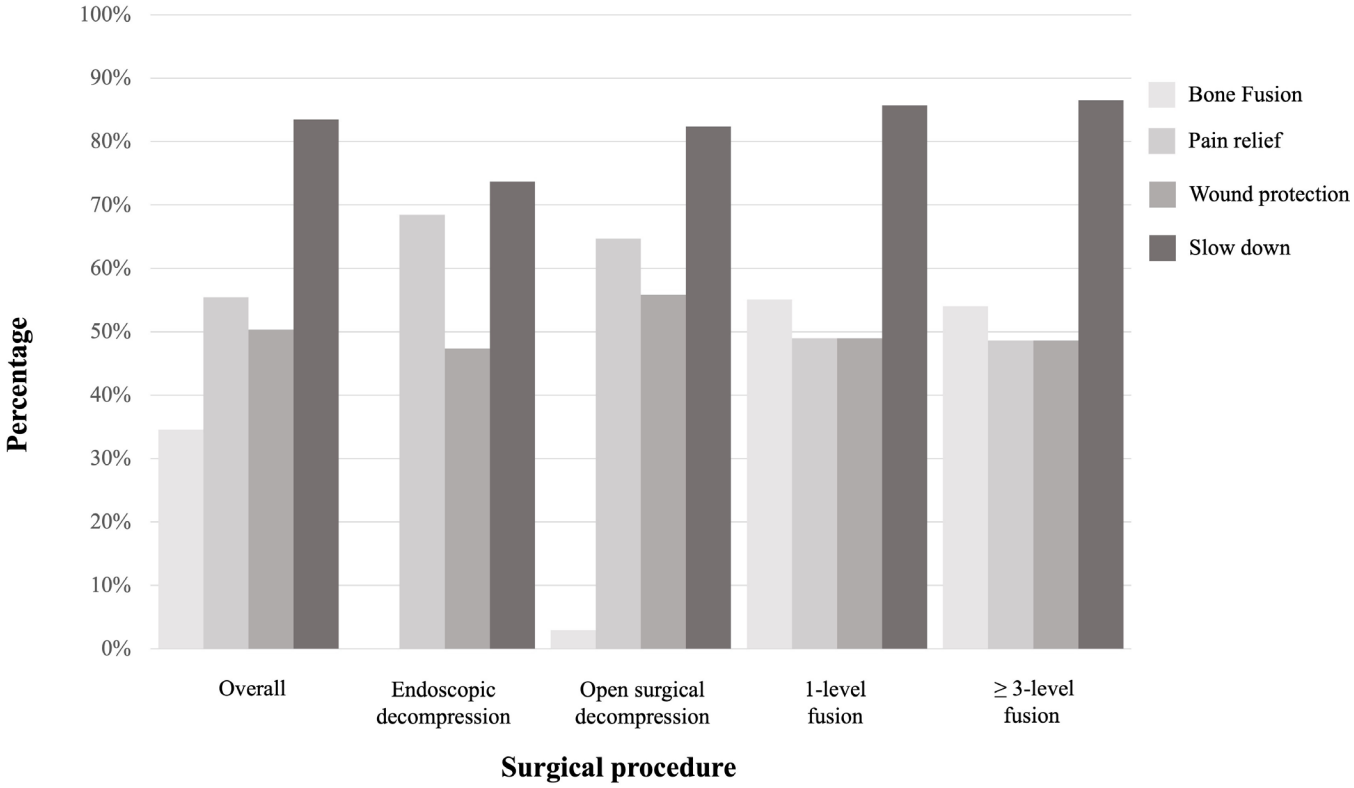

Figure 3. Purpose of brace prescription for each surgical procedure. Responses were obtained from respondents who regularly performed these surgical procedures, prescribed a brace, and chose all applicable responses from the 4 options.

knowledge of the subject, 11% of respondents possessed positive scientific knowledge, 11% possessed negative scientific knowledge, and 22% possessed both types of knowledge. Regarding the basis of the decision to prescribe braces, only 14% cited scientific evidence, whereas 43% referred to personal experiences and 43% relied on recommendations from colleagues or superiors. Nonscientific reasons for brace prescription, such as providing reassurance to the doctor or patient, adhering to traditions or customs, and contributing to hospital revenue, were chosen as at least 1 reason by 84% of respondents (Figure 5).

DISCUSSION

Regional Differences in Prescription Rates

The overall prescription rate observed in this study was 83%, with 66% for decompression procedures and 98% for fusion procedures. In comparison, previous studies conducted in Belgium reported rates of 38% overall, 21% for decompression, and 47% for fusion procedures.[10] In the United States, the rates were 26% overall, 13% for decompression, and 33% for fusion procedures.[12] The significantly higher prescription rates in our study suggest notable regional differences. One factor contributing to this difference is the inclusion of support belts, which were not included in previous studies. Even after excluding support belts, the rates in our study (65% overall, 35% for decompression, and 91% for fusion procedures) remained significantly higher than those reported in overseas studies.

Impact of Bone Quality and Demographics

A cross-sectional international survey on fusion surgery revealed that spine surgeons in the Asia-Pacific region had the highest prescription rates for postoperative braces (88%), primarily due to bone quality considerations.[13] Asian populations, including Chinese and Japanese, are more susceptible to vertebral fractures and implant failures compared with Caucasians, largely due to the high prevalence of osteoporosis and their fragile vertebral bones.[14,15]

The rapid aging of Japan's population significantly contributes to high brace prescription rates. Spine surgeries for patients aged 75 years or older with lumbar spinal stenosis have increased 12.6-fold in the past 20 years.[16] Advanced age and osteoporosis are key risk factors for poor bone quality, leading to complications such as adjacent segment disease and instrumentation failure,[17,18] resulting in higher reoperation rates and decreased patient satisfaction.[19]

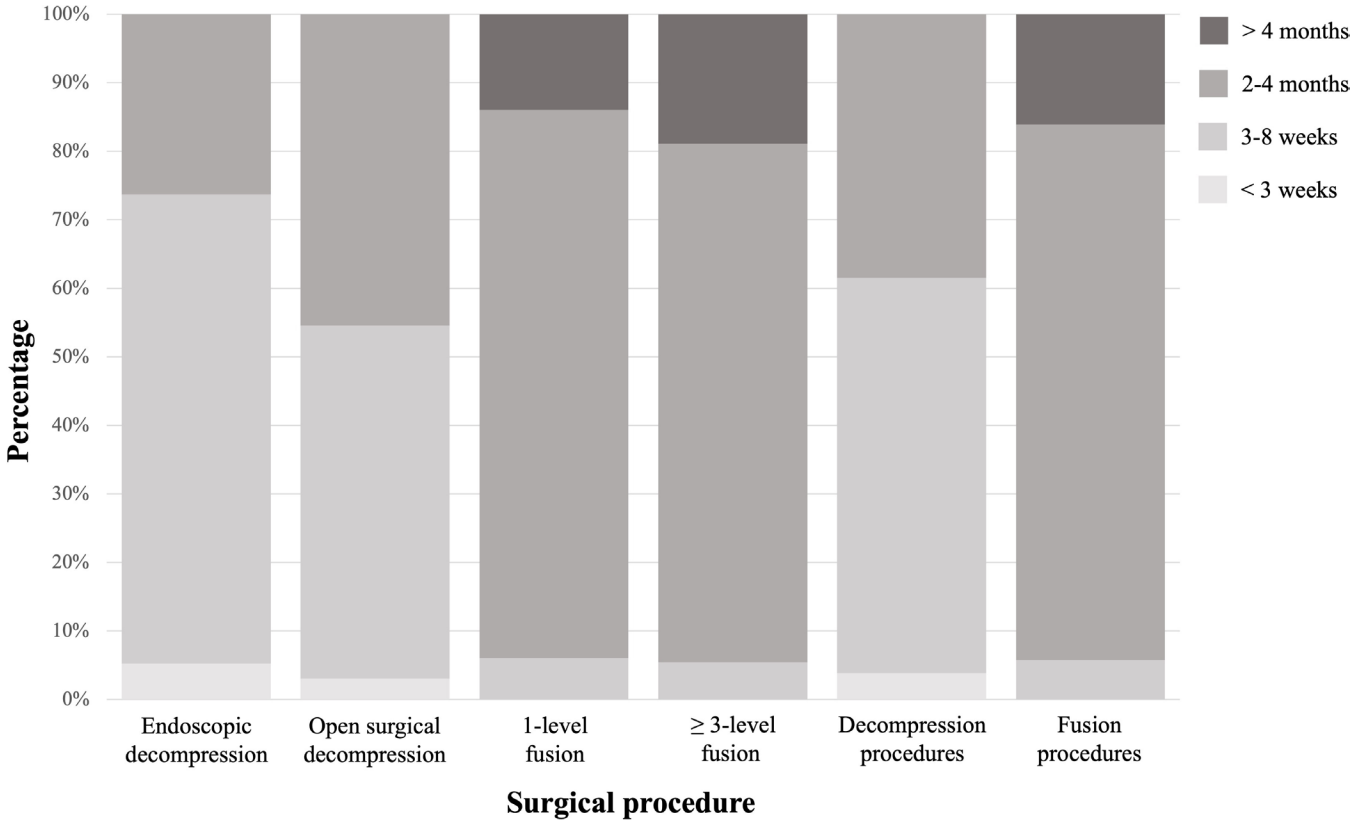

Figure 4. Duration of brace usage for each surgical procedure. Responses were obtained from respondents who regularly performed these surgical procedures, prescribed a brace, and selected 1 of the 4 duration options (<3 weeks, 3–8 weeks, 2–4 months, or ≥4 months).

To mitigate these risks, postoperative braces are often prescribed to slowdown excessive activity and provide additional support. In our study, 83% of respondents indicated that the primary purpose of prescribing braces was to slow down patient activity, which is more than double the rates reported in the United States (35%)[12] and Belgium (37%).[10] This higher rate of brace prescription may reflect concerns about mitigating the risks associated with poor bone quality and advanced age.

Although 3 randomized controlled trials, including 1 from Japan, reported that postoperative braces do not significantly affect clinical or radiological outcomes,[4,6,8] these studies had several limitations. The sample sizes were small, and osteoporotic cases were excluded. Further studies that address these limitations and specifically evaluate postoperative complications in older adults with osteoporosis are warranted. Given the global increase in aging populations and the high prevalence of osteoporosis, such research would be highly relevant not only in Asia but also in Western countries facing similar demographic trends.

Minimally Invasive Surgery and Brace Usage

Another factor influencing brace prescription rates is the advancement of surgical techniques, particularly minimally invasive surgery (MIS), which allows for reduced tissue disruption. Dramatic advances in MIS have developed, especially in the past 2 decades.[20] Endoscopic procedures, which allow for the preservation of supporting tissues such as muscles, ligaments, and joint capsules, may also contribute to the reduced need for postoperative bracing. Our study found that the prescription rate for postoperative braces was lower in endoscopic decompression compared with open surgery. Although no significant difference was observed, the trend of lower prescription rates and shorter usage durations suggests that advancements in MIS may reduce the need for bracing. The growing trend toward less invasive surgical approaches may play a significant role in reducing overall postoperative brace prescription rates.

Specialty Differences and Institutional Influence

All respondents were orthopedic surgeons. Belgian research found that orthopedic surgeons prescribe

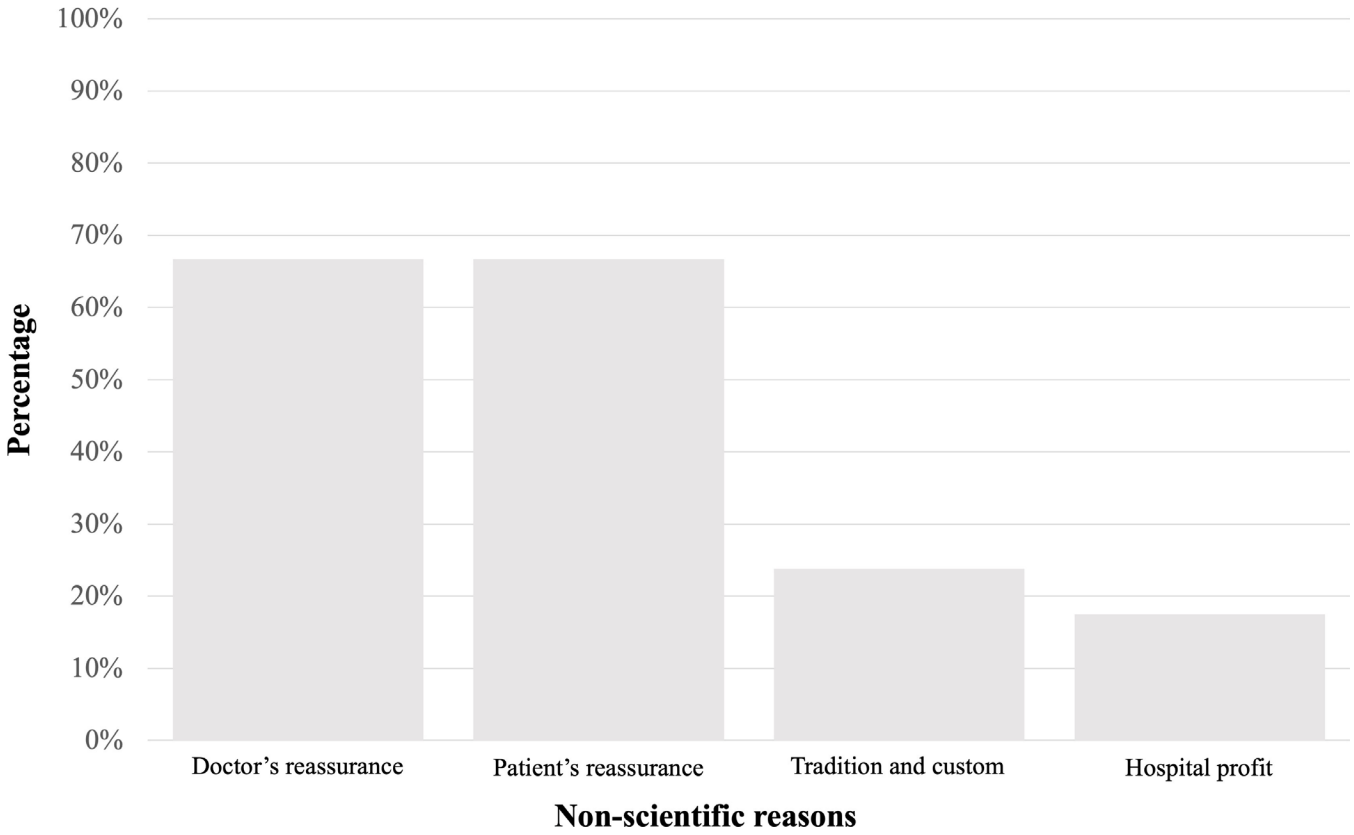

Figure 5. Nonscientific reasons for brace prescription. All respondents, regardless of whether they performed specific procedures, were required to select all applicable responses from the 4 options for nonscientific reasons for brace prescription.

braces more frequently than neurosurgeons.[10] Orthopedic surgeons, who regularly treat fractures, are more inclined toward bone fusion and external fixation, explaining the high prescription rates.

Prescription rates for endoscopic and open surgical decompression were linked to facility attributes and surgical volume, indicating these factors significantly influence brace prescription practices. Around half of the respondents mentioned that opposition from their department head would affect their future practices. These findings underscore the impact of workplace environment and institutional culture on prescription practices, highlighting the importance of leadership and guideline dissemination in clinical decision-making.

Global Reliance on Nonscientific Factors

The high prescription rate in this study may be due to a lack of knowledge about postoperative braces or a lack of original guidelines in Japan; it may also result in prescriptions lacking a sufficient scientific basis. Scientific evidence was the least cited indication for prescribing postoperative braces. Similarly, a Belgian survey[10] found only 29% of spine surgeons made their prescription decisions based on scientific evidence, with most relying on personal experience or tradition. United States guidelines[5] do not support rigid orthoses or prolonged brace use in fusion procedures, yet fusion surgery was associated with significantly higher prescription rates than decompression surgery in the United States (34% vs 16%), highlighting the gap between guidelines and practice. This indicates that a lack of reliance on scientific evidence is a global issue, suggesting general skepticism or a lack of emphasis on studies concerning brace efficacy. Cultural preferences, traditions, or perceived stability benefits may partially explain the continued practice despite the lack of scientific evidence. Moreover, nonscientific reasons, such as providing reassurance to doctors and patients, adherence to traditions, and hospital revenue considerations, were often cited. These factors may contribute to the low reliance on scientific evidence for postoperative brace use, indicating that cultural and economic factors significantly influence decision-making.

Medical Expenses

According to a report from the Health Survey Division of the Ministry of Health, Labor, and Welfare, the

medical expenses for trunk braces in the 2014 fiscal year amounted to 1.55 billion USD.[21] Furthermore, medical reimbursement related to brace prescriptions in the 2020 fiscal year was 0.47 billion USD. The casting costs for soft corsets and rigid orthoses are 63 and 161 USD, respectively, with purchase costs set by law at 173 and 181–347 USD, respectively. Rigid orthoses are more expensive than soft corsets. The high rate of brace prescriptions may contribute to high healthcare expenses, underscoring the importance of reevaluating brace prescription practices to minimize unnecessary healthcare costs.

Limitations

This study had some limitations. First, the participants were limited to specific institutions and specialties, introducing potential bias related to age and department. Also, the study focused on spine surgeons in Japan, which may limit the generalizability of our findings. Although the survey was conducted in the Kanto region, Japan's most populous area, and included participants from more than 26 facilities, the findings should still be interpreted with caution regarding their applicability to other regions. The limitations in regional and institutional diversity mean that the results cannot be fully representative of spine surgeons across Japan or other Asian regions and that generalizing these results may not be appropriate. However, these data provide valuable insights into regional practices and trends. Additionally, the survey was conducted within a designated time frame, resulting in a high response rate of 66 out of 69 participants.

CONCLUSION

Postoperative brace prescription rates among spine surgeons in Japan are significantly higher than those in Western countries, largely due to nonscientific factors, such as cultural influences, institutional practices, and physician reassurance aimed at slowing down patient activity. Comprehensive, evidence-based guidelines accounting for demographic and cultural contexts are needed for consistent brace usage and to optimize patient outcomes.

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Author Contributions: Michita Noma, Yujiro Takeshita, Fumiko Saeki, and Kota Miyoshi designed the study. Naohiro Kawamura, Akihiro Higashikawa, Nobuhiro Hara, and Takashi Ono advised on questionnaire preparation and collection of data. So Kato, Yoshitaka Matsubayashi, and Yuki Taniguchi advised on data analysis. Kota Miyoshi, Sakae Tanaka, and Yasushi Oshima supervised the experiments. Michita Noma wrote the manuscript.

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