Check for updates

Journal of Orthopaedic Surgery

Journal of Orthopaedic Surgery
33(3) 1–11
© The Author(s) 2025
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/10225536251386150
journals.sagepub.com/home/osj
Sage

Comparison of 0-degree and 30-degree endoscopes in unilateral biportal endoscopic decompression for lumbar spinal stenosis: Which preserves the facet joint better?

Abdullah Merter[1] and **Mustafa Özyıldıran**[2]

Abstract

Purpose: This study aimed to compare the radiological and clinical outcomes of unilateral biportal endoscopic lumbar decompression (UBELD) performed with 0-degree and 30-degree endoscopes.

Methods: Patients with single-level lumbar spinal stenosis without instability were included in this single-center retrospective study. The patients were categorized into two groups on the basis of the angle of the endoscope used by the surgeon. Clinical outcome measures included JOA scores, Oswestry Disability Index (ODI), and VAS scores for low back and leg pain, assessed preoperatively and at 12 months postoperatively. Ipsilateral and contralateral osteotomy angles, overhang distance, and ipsilateral inferior articular process (IAP) area were measured.

Results: Among the 81 patients who met the inclusion criteria, a 30-degree endoscope was used in 51 patients, while a 0-degree endoscope was used in 30 patients. The JOA score, VAS-leg score, VAS-low back pain score, and ODI significantly improved in both groups at the final follow-up period ($p < 0.001$). Postoperative VAS-low back pain score in the 30-degree endoscope group was significantly lower than that in the 0-degree endoscope group (1.4 vs 2.9, $p < 0.001$). Significant differences were also observed in the ipsilateral osteotomy angle (77.8° vs 87.8°, $p < 0.001$), overhang distance (−1.16 mm vs −4.39 mm, $p < 0.001$), and the postop/preop ratio of ipsilateral IAP area (0.74 vs 0.69, $p = 0.006$). Radiological parameters for facet preservation were better in the 30-degree endoscope group.

Conclusion: Successful clinical improvements were achieved with both endoscope angles. However, facet preservation parameters were more favorable in the 30-degree endoscope group compared to the 0-degree endoscope group.

Keywords

lumbar spinal stenosis, endoscopic decompression, unilateral biportal endoscopic lumbar decompression (UBELD), degree of endoscope, 30-degree endoscope, 0-degree endoscope, facet preservation

Received: 14 July 2025; revised: 7 September 2025; accepted: 24 September 2025

Introduction

Lumbar spinal stenosis is a prevalent degenerative disease characterized by the progressive narrowing of the spinal canal, typically presenting with neurogenic claudication, chronic low back pain, and radicular symptoms in the lower extremities.[1–3] Surgical intervention is recommended for individuals experiencing persistent severe pain or neurological symptoms that do not improve with conservative treatments.[4,5] For many years, the traditional surgical

[1]Department of Orthopedics and Traumatology, Ankara University, Ankara, Turkey
[2]Department of Orthopedics and Traumatology, Sandıklı State Hospital, Sandıklı, Turkey

Corresponding author:
Mustafa Özyıldıran, Department of Orthopedics and Traumatology, Sandıklı State Hospital, Sandıklı Devlet Hastanesi, İstasyon Caddesi No:58 Afyonkarahisar, Sandıklı 03500, Turkey.
Email: mozyildiran@gmail.com

Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (https://creativecommons.org/licenses/by-nc/4.0/) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (https://us.sagepub.com/en-us/nam/open-access-at-sage).

treatment was decompression with laminectomy.[2,6] This technique often leads to chronic low back pain due to extensive muscle dissection, instability from removing the posterior ligamentous complex and facet joints, and further damage to the already atrophic lumbar muscles due to age. Additionally, instrumented spinal stabilization is commonly performed to correct iatrogenic instability. Implant-related postoperative problems, such as adjacent segment disease, pseudoarthrosis, and infection, are frequently observed in the postoperative period.[2,3,7] To overcome the limitations of traditional open surgeries, the microscopic unilateral laminotomy for bilateral decompression (ULBD) technique was first described by Poletti et al. in 1995.[8] This technique allows bilateral decompression through unilateral approach with minimal dissection, preserving the integrity of posterior spine structures and facet joints. It provides effective decompression without the need for stabilization surgery.[9–11]

In parallel with the advancement of endoscopic techniques, attempts have been made in recent years to develop minimally invasive approaches using endoscopes in spinal decompression surgery.[2,4,11] Unilateral biportal endoscopic lumbar decompression (UBELD) is one of the most common endoscopic decompression techniques that has gained popularity in recent years.[11–13] UBELD is a biportal endoscopic technique that follows the purpose and philosophy of unilateral laminotomy for bilateral decompression (ULBD). This technique utilizes two distinct portals: the cranial portal for the endoscope and the caudal portal for instruments such as the radiofrequency (RF) ablation probe, burr, and Kerrison punches.[11,14–16] The distinct working and viewing portals offers a geometric advantage by allowing independent movement of the surgical instruments and the endoscope, thereby enhancing the maneuverability of the instruments.[4,11] Unilateral biportal endoscopy (UBE) does not require a tubular retractor or specialized endoscopy instruments with channels. One of the key advantages of UBE is that it is performed using 4.0 mm rigid endoscopes, which are commonly used in knee and shoulder arthroscopy. Another advantage is that large-sized traditional instruments, such as Kerrison punches, can also be used in UBELD.[11,14,17]

Previous studies have revealed that UBELD is an effective and safe minimally invasive technique that can achieve sufficient decompression of lumbar stenosis.[2,4,11,13] In the UBELD technique, either a 0-degree or 30-degree endoscope is used. The 30-degree endoscope is commonly used in orthopedic arthroscopic procedures and is readily available in most operating rooms. The 30-degree inclination angle of the endoscope allows for a wider field of view. On the other hand, the 0-degree endoscope is predominantly utilized in otolaryngologic procedures and may not be readily available in all surgical settings. The absence of an angled view and the direct forward visualization of the 0-degree endoscope are believed to facilitate its use, particularly for surgeons with limited experience in endoscopy. There are numerous studies in the literature reporting successful clinical and radiological outcomes with the use of both.[2,4,11–15] However, to the best of our knowledge, there is no study comparing the clinical and radiological outcomes of using either 30-degree or 0-degree endoscopes in UBELD. The question of which endoscope angle should be preferred in UBELD, as well as the potential advantages it may offer, is a common point of interest, particularly among surgeons who are new to this procedure. Therefore, this study aims to compare the clinical and radiological outcomes of UBELD performed with 0-degree and 30-degree endoscopes.

Materials and methods

This study was a retrospective analysis of prospectively collected data from patients treated between January 2017 and March 2021. Patients with radiologically and clinically confirmed single-level lumbar spinal stenosis without instability were included in this single-center retrospective study. This research was conducted following approval from the ethics committee of our institution. Written informed consents were obtained from the patients. The study was performed in accordance with the Declaration of Helsinki.

This research included patients who fulfilled all of the following inclusion criteria: (1) Single-level lumbar spinal stenosis confirmed by magnetic resonance imaging (MRI) findings. (2) Bilateral lower limb neurogenic claudication with radicular leg pain and comparable leg pain VAS scores (±1) in both lower limbs. (3) Undergoing UBELD procedures with either a 30-degree or 0-degree endoscope, performed by a surgeon experienced in endoscopic spinal surgery. (4) A minimum follow-up period of 12 months. The exclusion criteria were as follows: (1) Multi-level lumbar spinal stenosis. (2) Previous history of spinal surgeries. 3). Patients with lumbar instability (10 degrees of angular motion or 4 mm of translation in dynamic lumbar radiographies). 4) Patients who had a deformity with a Cobb angle of >20°. 5) Cases with accompanying foraminal/extraforaminal stenosis. 6) Cases in which discectomy was performed during the operation. 7) Patients with space occupying lesions in the spinal canal. 8) Follow-up period of less than 12 months 9) Patients whose clinical scores and radiological measurements were unavailable in the hospital records.

The study was conducted at a tertiary care university hospital. All surgical procedures were performed by the same senior spine surgeon experienced in endoscopic spine surgery. The patient is positioned in the prone position, and the preoperatively determined level of stenosis is marked under fluoroscopic guidance. Two small skin incisions, approximately 0.5-1 cm in length, are made, and portals are created using continuous dilators. The unilateral biportal endoscopic lumbar decompression (UBELD) technique utilizes two separate unilateral portals for visualization and

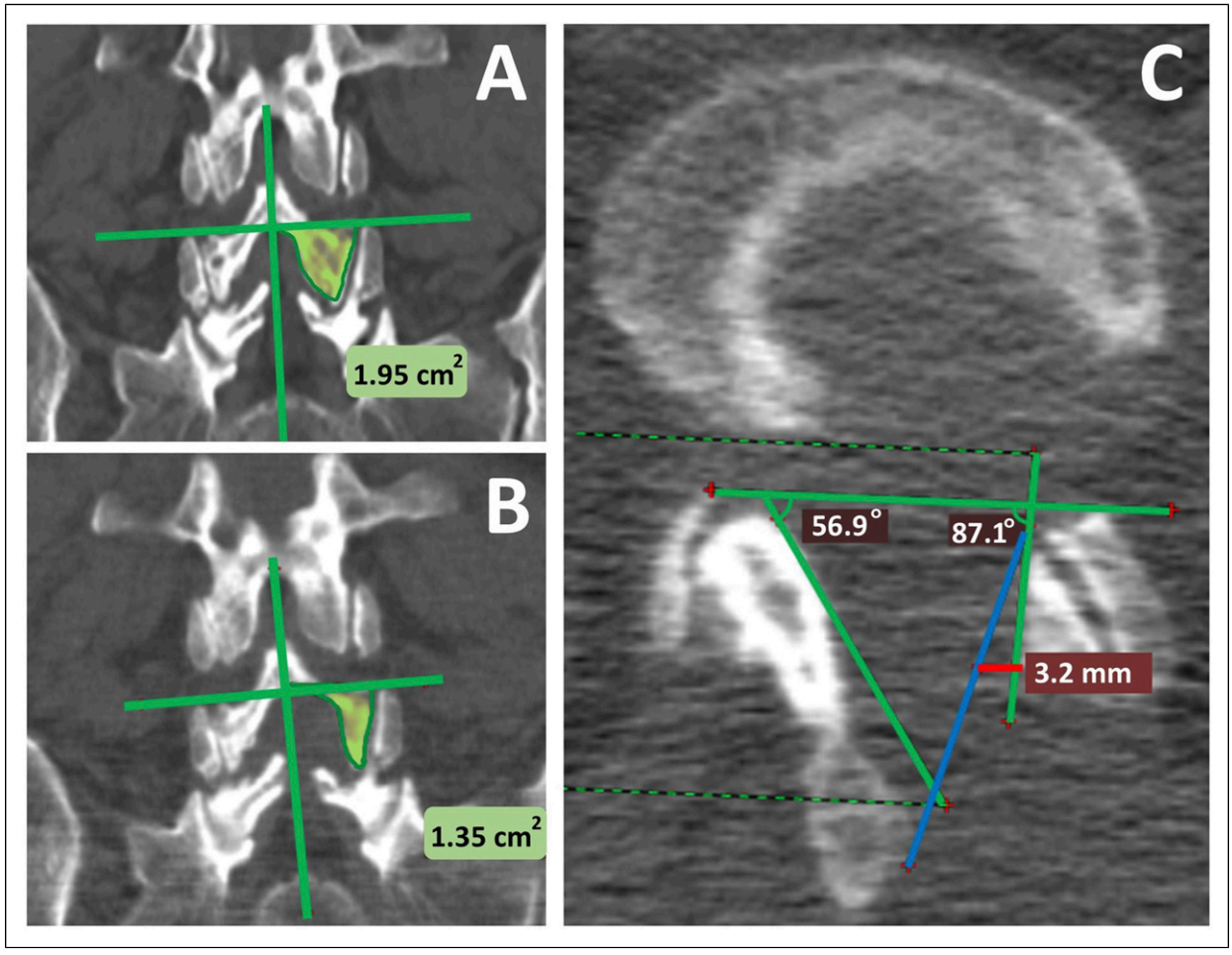


Figure 1. Measurement of radiological parameters using computed tomography scans. (A) Preoperative area of the ipsilateral inferior articular process. The measurement is taken on the image where the two laminae are the thickest in the coronal section. The vertical line represents the midline, while the horizontal line passes through the tip of the superior articular process; (B) Postoperative area of the ipsilateral inferior articular process; (C) Measurement of ipsilateral osteotomy angle, contralateral osteotomy angle and overhang distance. The osteotomy angle is the angle between the osteotomy line of the facet and the horizontal line joining the ventral margins of the superior articular processes. In this illustration, both lines are shown in green, with the ipsilateral osteotomy angle measured as 87.1° and the contralateral osteotomy angle measured as 56.9°. The overhang distance is the horizontal distance between the dorsal tip of the resected inferior articular process and the tangent line connecting the surface of the spinous process and the ventral edge of the resected facet. In this figure, the tangent line is presented in dark blue, while the overhang distance is shown in red.

working. A 30-degree or 0-degree, 4.0 mm endoscope (Karl Storz, Tuttlingen, Germany) is used. In our operating suite, the number of available endoscopes are limited; thus, the selection of a 0° or 30° endoscope is determined randomly by factors such as sterilization status and concurrent use in other operating rooms, and was independent of patient characteristics, surgical complexity, or surgeon preference. The endoscope is advanced through the cranial (viewing) portal, while instruments such as a radiofrequency (RF) ablation probe, burr, and Kerrison punches are inserted through the caudal (working) portal. Lumbar decompression procedures are conducted in accordance with the principles of unilateral laminotomy for bilateral decompression (ULBD). Bilateral decompression is performed until the lateral edges of both traversing nerve roots and the intervertebral disc are visualized on the screen. Patients were retrospectively categorized into two groups according to the type of endoscope used by the surgeon during the procedure.

Pre- and postoperative radiological imaging data, including anteroposterior and lateral flexion-extension radiographs, CT scans, and MRI, were analyzed. Radiological evaluation of facet preservation was conducted through measurements of osteotomy angle and overhang distance. The area of the ipsilateral inferior articular process (IAP) was also measured to assess the bone resection area. The preoperative and postoperative measurements of the ipsilateral IAP area were performed using coronal CT scans. The details of how the measurements were performed were explained in Figure 1. The osteotomy angle and the overhang distance were measured on axial CT images at the level

Table 1. Demographics and patient characteristics.

		30° endoscope (n = 51)	0° endoscope (n = 30)	Total (n = 81)	*p* value
Age		73.1 (±9.0)	73.9 (±7.9)	73.4 (±8.6)	0.687
Sex	Male	19 (37.3%)	11 (36.7%)	30 (37.0%)	0.958
	Female	32 (62.7%)	19 (63.3%)	51 (63.0%)	
Level	L2/3	1 (2.0%)	2 (6.7%)	3 (3.7%)	0.897
	L3/4	15 (29.4%)	7 (23.3%)	22 (27.2%)	
	L4/5	28 (54.9%)	20 (66.7%)	48 (59.3%)	
	L5/S1	7 (13.7%)	1 (3.3%)	8 (9.9%)	

*Student's t-test was used for numerical data comparison, while the Chi-square test was used for categorical data. Differences with *p*-values >0.05 were considered not statistically significant.

at which the facet joint was maximally visualized. The osteotomy angle is defined as the angle formed between the osteotomy line of the facet and the horizontal line connecting the anterior edges of the superior articular processes. We recorded the osteotomy angle measurements for both the approach side, where laminotomy was performed, and the contralateral side. These measurements were expressed as ipsilateral and contralateral values (Figure 1(c)). "Overhang distance", an index developed by Nakamura et al., is another parameter used to assess facet preservation.[18] In cases where the spinous process leans toward the approach side or the lamina is narrow, the osteotomy angle may not be reliable. Therefore, Nakamura et al. developed "overhang distance" as a parameter for assessing facet preservation.[18] The overhang distance is the horizontal distance between the dorsal tip of the resected medial facet and the tangent line connecting the surface of the spinous process to the ventral edge of the resected facet. The overhang distance has a positive value when the dorsal tip of the resected facet is medial to the tangent line, and a negative value when the dorsal tip of the resected facet extends lateral to the tangent line. A smaller overhang distance and a greater osteotomy angle are considered indicators of worse facet preservation. All radiological measurements were performed using a DICOM viewer (POP-net webserver, Image ONE Co., Tokyo, Japan). All radiological assessments were performed twice at a 2-weeks interval by two blinded spine surgeons to determine intra-observer and inter-observer reliabilities of the radiological measurements. Intraclass correlation coefficients (ICC) were calculated for all measurements. The intra-observer ICC values for each observer were 0.92 and 0.90, indicating excellent reliability (ICC ≥0.90). The inter-observer ICC was 0.88, indicating good reliability (ICC between 0.75 and 0.90).[19] The average of two separate measurements obtained by a single investigator was used in the analyses, as these results demonstrated excellent reliability according to Winer's criteria.[20]

Clinical improvement was assessed using the Japanese Orthopaedic Association (JOA) score, the Oswestry Disability Index (ODI), and the Visual Analog Scale (VAS), administered preoperatively and at 12 months postoperatively. The Visual Analog Scale (VAS) was applied under two separate subheadings: low back pain VAS and leg pain VAS. Since we aimed to evaluate decompression in both lateral recesses, including the approach side (ipsilateral) and the contralateral side, patients with pain predominantly in one leg were excluded. Therefore, we only included patients whose preoperative VAS scores in both legs were close to each other (within ±1 VAS score). The mean VAS score of both legs was used for the assessment of leg pain.

Statistical analysis was performed using SPSS v.22.0 (SPSS Inc.,Chicago, IL). Descriptive statistics were used to characterize demographic variables of patients. Mean, median and standard deviation values were used to show descriptive statistics. The Kolmogorov-Smirnov and Shapiro-Wilk test were used to assess the normality of the data. Student's t-test and Mann–Whitney U test were used to compare the clinical and radiological outcomes of the groups, depending on whether the data were parametric or non-parametric. The paired sample t-test and Wilcoxon test were used to analyze data from dependent groups (pre-post comparisons). Chi-square and Fisher's exact tests were used for categorical variables. Spearman's test was used to assess the correlations between radiological parameters and clinical scores. A p-value of less than 0.05 was considered statistically significant. A post hoc power analysis was performed with G*Power, version 3.1.9.7 (Heinrich Heine University, Düsseldorf, Germany). to evaluate the ability of the current sample size to detect clinically relevant differences between groups.

Results

During the specified time period, 601 patients underwent UBELD for single level lumbar spinal stenosis, and 81 patients who met the inclusion criteria were evaluated in the study. These patients were composed of 30 males (37.0%) and 51 females (63.0%), with a mean age of 73.4 years. Among the patients who met the inclusion criteria, the 30-degree endoscope was used in 51 patients, while the 0-degree endoscope was used in 30 patients. The patient characteristics were presented in Table 1. The minimum follow-up period was 12 months.

Table 2. Comparison of clinical scores between treatment groups.

	30° endoscope (n = 51)	0° endoscope (n = 30)	*p* value
JOA score			
Preoperative	8.8 (±4.0)	9.7 (±4.3)	0.231
Postoperative 12th month	21.9 (±3.3)	21.3 (±3.3)	0.324
Oswestry disability index (ODI)			
Preoperative	79.7 (±7.1)	81.1 (±6.3)	0.392
Postoperative 12th month	16.0 (±2.8)	15.3 (±2.6)	0.273
Leg pain VAS			
Preoperative	6.8 (±1.5)	6.9 (±1.2)	0.516
Postoperative 12th month	1.0 (±0.7)	1.2 (±0.6)	0.231
Low back pain VAS			
Preoperative	5.1 (±1.2)	4.9 (±0.6)	0.844
Postoperative 12th month	1.4 (±0.5)	2.9 (±0.5)	<0.001

*Student's t-test was used for parametric data comparison, while the Mann-Whitney U test was used for nonparametric data. *p*-values <0.05 were considered statistically significant.
**Abbreviations: JOA: japanese orthopaedic association; ODI: oswestry disability index; VAS: visual analog scale.

Preoperative and postoperative clinical scores of treatment groups were presented in Table 2. The preoperative Japanese Orthopaedic Association (JOA) scores in the groups were 8.8 and 9.7, while these values were observed to be 21.9 and 21.3 at the postoperative 12th month. Postoperative improvement in JOA score was observed in both treatment groups. However, there was no significant difference in terms of JOA score between the groups during the preoperative and postoperative periods ($p = 0.231$ and $p = 0.324$, respectively). In terms of the Oswestry disability Index (ODI), no significant difference was observed between the groups in the preoperative period and at the 12th postoperative month. The preoperative ODI scores in the groups were 79.7 and 81.1, while these values were observed to be 16.0 and 15.3 at the 12th postoperative month. Postoperative improvement in ODI score was observed in both treatment groups.

As with the ODI and JOA scores, there was a statistically significant improvement in leg pain VAS and low back pain VAS scores in both treatment groups compared to the preoperative period ($p < 0.001$). The preoperative leg pain VAS scores in the groups were 6.8 and 6.9, while these values were observed to be 1.0 and 1.2 at the 12th postoperative month. No significant difference was observed between the groups in terms of leg pain VAS score during the preoperative and postoperative periods ($p = 0.516$ and $p = 0.231$, respectively). Similarly, no significant difference was observed between the groups regarding the preoperative low back pain VAS score (5.1 vs 4.9, $p = 0.844$). However, at the 12th postoperative month, it was significantly lower in the 30-degree endoscope group compared to the 0-degree endoscope group (1.4 vs 2.9, $p < 0.001$) (Table 2). Facet fracture or postoperative instability did not occur in either patient group during the 12-months follow-up period.

Table 3. Comparison of radiological parameters between treatment groups.

	30° endoscope (n = 51)	0° endoscope (n = 30)	*p* value
Overhang distance (mm)	−1.16 (±1.59)	−4.39 (±0.60)	<0.001
Ipsilateral osteotomy angle	77.8 (±4.1)	87.8 (±2.8)	<0.001
Contralateral osteotomy angle	61.0 (±4.5)	59.8 (±2.4)	0.119
Surface area of the ipsilateral inferior articular process (cm^2)			
Preoperative	2.24 (±0.29)	2.25 (±0.14)	0.139
Postoperative	1.64 (±0.34)	1.55 (±0.16)	0.009
Postop/Preop ratio	0.74 (±0.12)	0.69 (±0.08)	0.006

*Student's t-test was used for parametric data comparison, while the Mann-Whitney U test was used for nonparametric data. *p*-values <0.05 were considered statistically significant.
**Abbreviations: Preop: preoperative; Postop: postoperative.

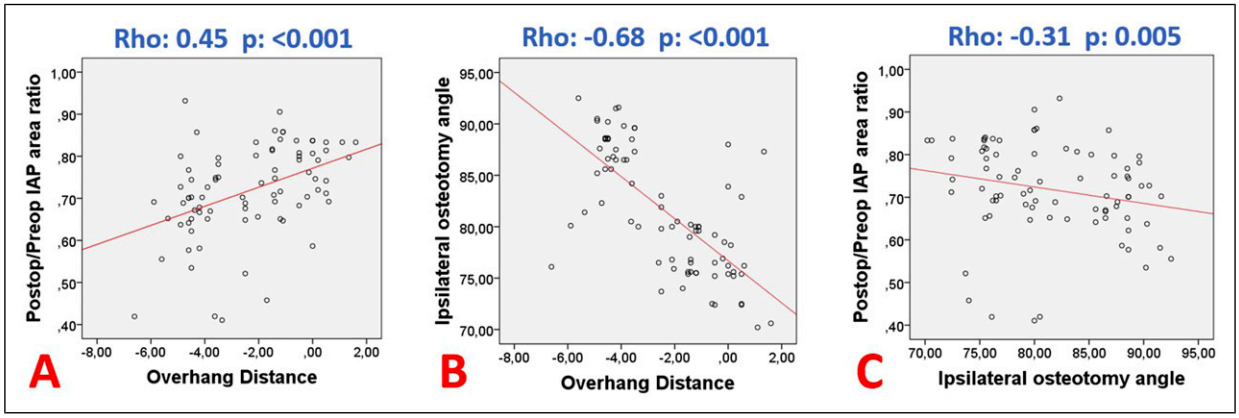


Figure 2. Pairwise correlations between overhang distance, ipsilateral osteotomy angle, and postoperative/preoperative inferior articular process (IAP) surface area ratio. (A) Scatter plot depicting the relationship between overhang distance and postoperative/preoperative inferior articular process surface area ratio; (B) Scatter plot of overhang distance versus ipsilateral osteotomy angle; (C) Scatter plot showing the correlation between ipsilateral osteotomy angle and postoperative/preoperative inferior articular process surface area ratio. The red lines represent the linear regression analysis, with the corresponding rho and p-values.

The comparison of radiological parameters between the groups was presented in Table 3. Overhang distance was found to be significantly lower in the 0-degree endoscope group compared to the 30-degree endoscope group (−4.39 vs −1.16, $p < 0.001$). Similarly, the ipsilateral osteotomy angle was found to be significantly greater in the 0-degree endoscope group (87.8 vs 77.8, $p < 0.001$). However, there was no significant difference regarding the contralateral osteotomy angle between the groups (59.8 vs 61.0, $p = 0.119$). The surface area of the ipsilateral inferior articular process (IAP) was also evaluated. The preoperative value was 2.24 cm^2 in the 30-degree endoscope group, while it was 2.25 cm^2 in the 0-degree endoscope group. No significant difference was observed in these preoperative values ($p = 0.139$). On the other hand, the postoperative surface area of the IAP was found to be significantly smaller in the 0-degree endoscope group (1.55 vs 1.64, $p = 0.009$). The postop/preop IAP surface area ratio was also found to be significantly lower in the 0-degree endoscope group (0.69 vs 0.74, $p = 0.006$) (Table 3).

Post-hoc power analyses were conducted for the primary outcome parameters that demonstrated significant differences between groups. The effect sizes were very large, with Cohen's d values of 3.0 for low back pain VAS, 2.69 for overhang distance, and 2.85 for the ipsilateral osteotomy angle. All of these comparisons yielded post-hoc statistical power greater than 0.99, supporting the robustness and reliability of the observed differences.

We evaluated correlations between radiological parameters using the Spearman correlation test and presented the

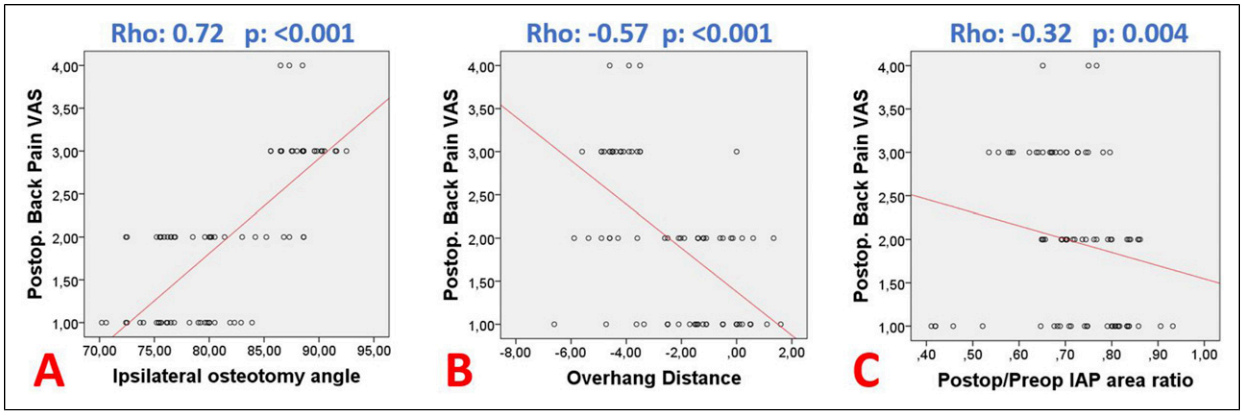


Figure 3. Correlations between radiological parameters and postoperative low back pain VAS scores. (A) Scatter plot depicting the relationship between ipsilateral osteotomy angle and postoperative low back pain VAS score; (B) Scatter plot of overhang distance versus postoperative low back pain VAS score; (C) Scatter plot showing the correlation postoperative low back pain VAS score and postoperative/preoperative inferior articular process surface area ratio. The red lines represent the linear regression analysis, with the corresponding rho and *p*-values.

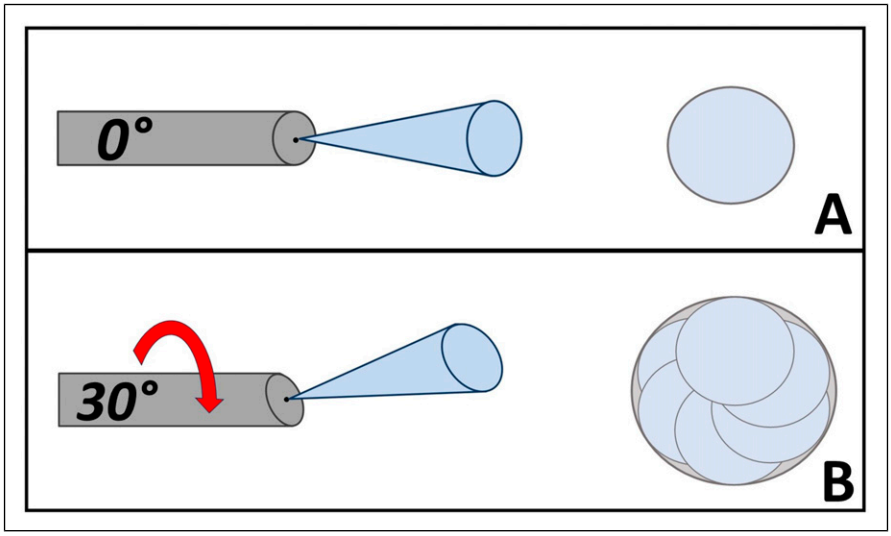


Figure 4. Illustration comparing 0° and 30° endoscopes and their visual fields. (A) 0° endoscope and its visual field; (B) 30° endoscope and its visual field. Rotating the 30-degree endoscope allows for a much larger field of view.

significant results in Figure 2. The Spearman correlation test between overhang distance and postop/preop IAP surface area ratio showed a significant correlation (rho = 0.45, $p < 0.001$). Significant correlations were also observed, such as between overhang distance and ipsilateral osteotomy angle (rho = −0.68, $p < 0.001$), and between ipsilateral osteotomy angle and the postop/preop IAP surface area ratio (rho = −0.31, $p = 0.005$) (Figure 2).

Correlations between radiological parameters and postoperative clinical scores were also evaluated, and significant results were presented in Figure 3. The correlation between ipsilateral osteotomy angle and postoperative low back pain VAS score was statistically significant and strong (rho = 0.72, $p < 0.001$). Significant correlations were also observed between overhang distance and postoperative low back pain VAS score (rho = −0.57, $p < 0.001$), as well as between the postop/preop IAP surface area ratio and postoperative low back pain VAS score (rho = −0.32, $p = 0.004$). These results show a negative correlation between facet preservation and low back pain VAS scores (Figure 3).

Discussion

Endoscopy plays a crucial role in modern medical practice. Although the concept of endoscopy has existed for centuries, it gained an important place in modern medicine as a result of significant advancements in optical technology during the last century.[21,22] The rigid glass-rod system described by Harold Hopkins is considered one of the most important milestones in the development of modern endoscopy and surgical optics.[21,23] Previous endoscope designs, relied on glass lenses within an air tube to transmit images. Realizing that the refractive index of glass was 1.5 times greater than that of air, Harold Hopkins developed a new endoscope designed to improve light conduction. He replaced air with glass and created a system of glass rods with air lenses interspersed between them.[21,23,24] In 1959, Hopkins patented his system, which was found to be much more advantageous than traditional lenses in terms of refractive index, field of view, and light transmission. The system was later purchased by Karl Storz and began to be produced as the Hopkins rigid endoscope.[24,25] Progressive improvements in lens and high-definition camera monitoring systems have made advanced endoscopic operative techniques possible in virtually every subfield of medicine, including laparoscopy, cystoscopy, arthroscopy, ventriculoscopy, and spinal endoscopy.[24–29]

Hopkins rigid endoscopes are manufactured with inclination angles ranging from 0° to 120°, enabling optimized visualization for various surgical procedures. The inclination angle, defined as the angle between the axis of the endoscope and a line perpendicular to the surface of the optic, can range from 0° to 120°.[23,27] The 0° and 30° endoscopes are the most commonly preferred standard rigid optics. The 0-degree endoscope is identified as forward-viewing, and the 30-degree endoscope as forward-oblique–viewing.[25,27] Rotation of the 30-degree endoscope allows a much larger field of view to be observed. For lateral axis visualization, the 30-degree laparoscope is typically considered superior to the 0-degree scope.[23,26,27] On the other hand, 0-degree forward-viewing endoscopes are easier for surgeons with limited endoscopy experience to use, as the visual field remains constant regardless of the axis of rotation on which the endoscope is held.[25,26] An illustration comparing the 0° and 30° endoscopes and their visual fields was presented in Figure 4.

Unilateral biportal endoscopic lumbar decompression (UBELD) has gained widespread popularity in recent years

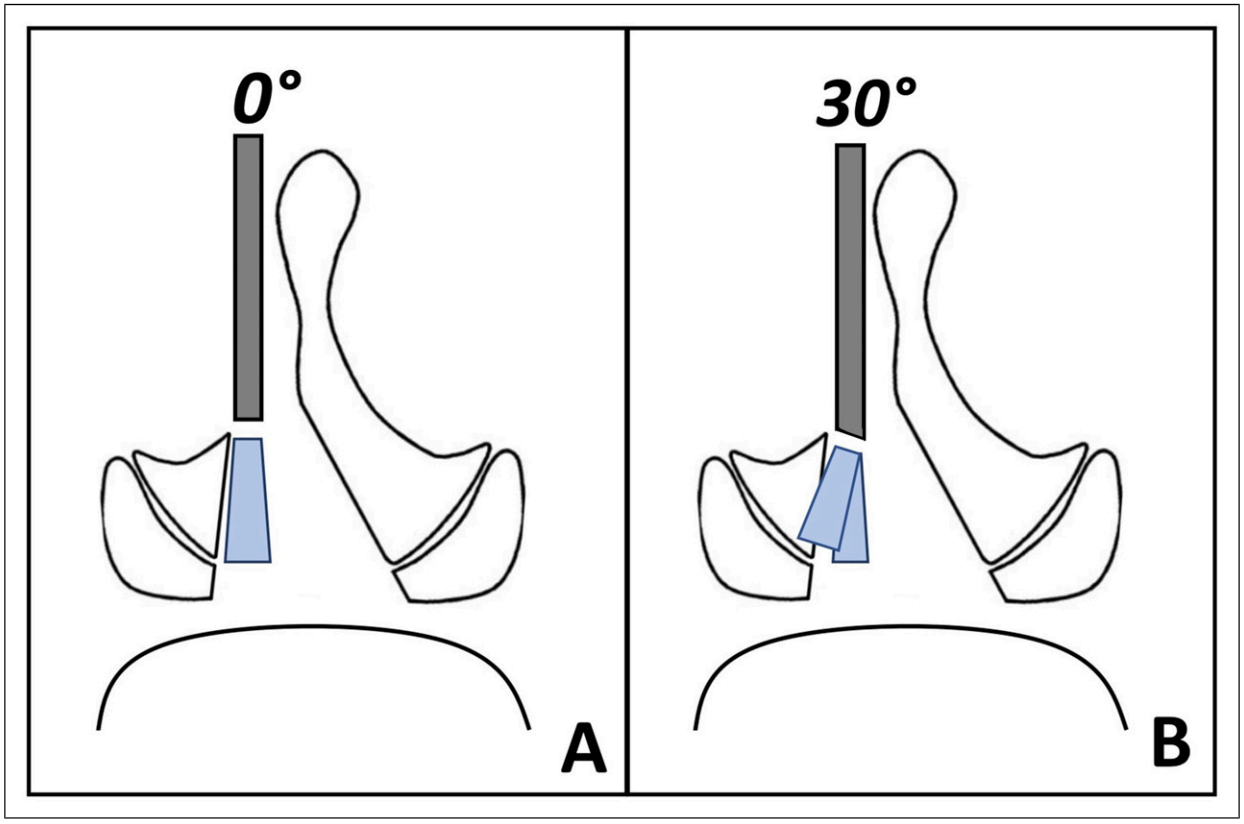


Figure 5. Illustrative comparison of the fields of view of the 0° and 30° endoscopes on the approach side (A) 0° endoscope and its field of view on the approach side during unilateral laminotomy for bilateral decompression (ULBD) procedure; (B) The angle of inclination, defined as the angle between the axis of the endoscope and a line perpendicular to the lens surface, offers an advantage in visualizing the ipsilateral facet and lateral recess when using a 30° endoscope.

as one of the most effective endoscopic techniques for spinal decompression.[11,12,14,28,29] One of the main advantages of UBELD is the use of 4.0 mm standard Hopkins rigid endoscopes, commonly used in knee and shoulder arthroscopy.[4,11,14] The lack of need for a tubular retractor or a specialized endoscope with a working channel is a significant advantage of the UBELD technique, providing easier and more cost-effective access to the necessary technical equipment.[11,14,17] In the UBELD technique, either a 0-degree or 30-degree endoscope may be utilized. In the literature on the UBELD technique, there are many studies reporting successful clinical outcomes for both types of endoscope angles.[4,11–15,17] However, to our knowledge, there has been no study that compares the clinical and radiological outcomes of using 0-degree versus 30-degree endoscopes in the UBELD technique.

There are few clinical studies in the literature comparing the use of 0-degree and 30-degree endoscopes, most of which are laparoscopic and cystoscopic studies conducted in the fields of general surgery, obstetrics, and urology.[25,26] Perrone et al. compared the use of 0-degree and 30-degree endoscopes in laparoscopic urologic surgeries using in vitro experimental models that simulated prostate dissection from the rectum, cystic duct clipping, and distal posterior rectum dissection.[25] They reported that the 30-degree rigid optics were superior to the 0-degree rigid optics in terms of time to complete each task, operative precision, and subjective surgeon rating scores.[25] Klangsin et al. conducted a prospective cohort study on gynecologic laparoscopies performed at their hospital.[26] Three expert surgeons and three non-expert surgeons evaluated the video recordings for visualization quality and their confidence in identifying the inferior epigastric vessel, rectus abdominis muscle, and bladder dome using both 0-degree and 30-degree laparoscopes. They found no significant difference between the two laparoscope angles regarding visualization quality and confidence in identifying the anatomical landmarks. However, in the evaluation of video recordings from surgeries using the 30-degree laparoscope, it was observed that expert surgeons reported significantly higher visual rating scale scores for both visualization quality and confidence level compared to non-expert surgeons.[26]

The principal strength of our research is that it is the first to compare the use of 0-degree and 30-degree endoscopes in unilateral biportal endoscopic decompression for lumbar spinal stenosis. We measured the ipsilateral facet osteotomy

angle and overhang distance to assess facet preservation. We found that the mean osteotomy angle of the ipsilateral facet joint in the 0-degree endoscope group was significantly greater than that in the 30-degree endoscope group. Similarly, the mean overhang distance was smaller in the 0-degree endoscope group. This finding indicates that a 30-degree endoscope can minimize ipsilateral facet joint damage while fully decompressing the ipsilateral nerve roots. Additionally, we observed that the ratio of bone resection applied to the inferior articular process during laminotomy was smaller in the 30-degree endoscope group. We found a significant correlation between these radiologic parameters and postoperative low back pain VAS scores. It was observed that the 30-degree endoscope group had better results in terms of postoperative low back pain VAS scores compared with the 0-degree endoscope group. At the 12th postoperative month, the low back pain VAS score was significantly lower in the 30-degree endoscope group than in the 0-degree endoscope group (1.4 vs 2.9, $p < 0.001$). There was a 1.5-unit difference in the mean low back pain VAS scores between the groups. Ostelo et al., in their international consensus publication, specified a minimum clinically important difference (MCID) threshold of 1.5 points for VAS (equivalent to 15 on a 100-point scale).[30] In our study, the intergroup difference in low back pain VAS scores met the MCID threshold. However, no significant difference was observed between the two groups in terms of other clinical outcome scores. Clinical scores showed significant improvement in both groups compared to the preoperative period.

Unlike in laparoscopy and cystoscopy procedures, the working space during the ULBD procedure is limited, resulting in a very narrow area for maneuvering the endoscope and other instruments. The 30-degree endoscope, with its angle of inclination, offers an advantage in visualizing the ipsilateral facet and lateral recess. Figure 5 presents a comparison of the fields of view of the 0° and 30° endoscopes on the approach side during the unilateral laminotomy for bilateral decompression (ULBD) procedure. We believe that the 30-degree endoscope is superior to the 0-degree endoscope in terms of ipsilateral facet and ipsilateral recess visualization due to its oblique viewing capability and larger field of view. The radiologic and clinical results of our study support this hypothesis. On the other hand, the 0-degree endoscope also has some advantages. It is known that the 0-degree endoscope provides an advantage in terms of orientation over angled endoscopes, especially for surgeons with limited endoscopy experience.[26,27,31] Due to their direct forward-viewing capabilities, 0-degree endoscopes provide a visual field along the axis of the endoscope. In contrast, angled endoscopes have oblique viewing capabilities and exhibit image distortion at the periphery, known as the "fisheye view", where the peripheral structures appear more curved and compressed.[32,33] To avoid image distortion in the target area and prevent interference with instruments advanced through the working portal, the 30-degree endoscope should be maintained at an optimal distance from the target area without getting too close. On the other hand, the 0-degree endoscope can be advanced to much closer distances, which, in combination with the effect of irrigation fluid pressure, enhances visual quality. For these reasons, the 0-degree endoscope can provide ease of use for surgeons who do not have sufficient arthroscopy experience with the 30-degree endoscope.

This study focused exclusively on patients with single-level lumbar spinal stenosis who underwent posterior decompression via ULBD. Patients who underwent endoscopic discectomy during the operation were excluded from our study. Our study does not include data on patients who underwent discectomy in addition to posterior decompression during ULBD or those who underwent endoscopic discectomy alone, as these are subjects of separate studies. In order to guide future research, we believe it is crucial to share our insights on this topic, even though we do not have sufficient data. We believe there are notable differences in the use of 0-degree and 30-degree endoscopes in patients who underwent discectomy compared to our patient group. The 30-degree endoscope provides better visualization of the ipsilateral facet and recess compared to the 0-degree endoscope. However, this may be a disadvantage for cases requiring discectomy. Although a 30-degree endoscope enables visualization of the nerve root with minimal facet resection, it may necessitate more retraction of the traversing root to reach the disc. Therefore, the risk of nerve root traction injury and potential development of dysesthesia should be considered. If discectomy is to be performed, we recommend the use of a 0-degree endoscope whenever possible. In cases where discectomy is planned and a 30-degree endoscope is used, we suggest osteotomizing the medial facet until the instrument inserted through the working portal is perpendicular to the lateral border of the traversing root, in order to minimize root retraction.

Our study has several limitations. First, it was a single-center, retrospective study with a limited sample size. The use of a 0° or 30° endoscope was determined randomly by circumstances such as sterilization status and concurrent use in other operating rooms, independent of patient characteristics or surgical complexity. Since there were no differences in baseline clinical and demographic characteristics between the groups, we believe that the choice of endoscope did not introduce selection bias. Nevertheless, the retrospective design of our study represents a limitation with respect to randomization, and a prospective randomized study would be more informative to ensure that group allocation does not introduce such bias.

Another limitation of our study is the absence of quantitative data on the learning curve for 0° versus 30° endoscopes. The 0° endoscope provides direct forward viewing, and its visual field remains constant regardless of the axis of rotation, which facilitates intraoperative

orientation. Although a greater inclination angle expands the visual field, it is known that intraoperative orientation becomes more difficult for less experienced surgeons.[24,31,34] All surgical procedures in our study were performed by a senior endoscopic spine surgeon who also had extensive experience with the use of a 30° arthroscope in shoulder and knee arthroscopy. In the present study, the operating surgeon's proficiency with both 0° and 30° endoscopes minimized the likelihood of differences between the study groups attributable to endoscopic experience. However, for novice surgeons without sufficient endoscopic experience, the use of a 30° endoscope requires a learning process, and the generalizability of our findings to this group should be interpreted with caution. A further limitation is that the outcomes were evaluated only through radiological parameters and clinical outcome scores, without the use of a visual rating scale for intraoperative visualization. Another limitation of our study is that the findings are limited to a 12-months postoperative follow-up. Additional long-term data are required to obtain a more comprehensive understanding of the clinical outcomes. A randomized prospective trial involving a larger cohort and longer follow-up period provide more informative and reliable evidence.

Conclusion

The UBELD technique can be effectively performed using both 0-degree and 30-degree endoscopes. Sufficient decompression of lumbar stenosis was achieved with both types of endoscopes, and both groups demonstrated significant improvement in clinical scores compared to the preoperative period. However, ipsilateral facet preservation parameters were found to be more favorable in the 30-degree endoscope group than in the 0-degree endoscope group.

ORCID iDs

Abdullah Merter https://orcid.org/0000-0001-6796-3176
Mustafa Özyıldıran https://orcid.org/0000-0002-2187-9267

Ethical consideration

The study was performed in accordance with the Declaration of Helsinki and was approved by the ethics committee of our institution (Decree No: i03-287-25).

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. Weinstein JN, Lurie JD, Tosteson TD, et al. Surgical versus nonsurgical treatment for lumbar degenerative spondylolisthesis. *N Engl J Med* 2007; 356(22): 2257–2270.
2. Kim N and Jung SB. Percutaneous unilateral biportal Endoscopic spine surgery using a 30-Degree arthroscope in patients with severe lumbar spinal stenosis: a technical note. *Clin Spine Surg* 2019; 32(8): 324–329.
3. Phan K and Mobbs RJ. Minimally invasive versus open laminectomy for lumbar stenosis a systematic review and meta-analysis. *Spine* 2016; 41(2): E91–E100.
4. Tang Z, Tan J, Shen M, et al. Comparative efficacy of unilateral biportal and percutaneous endoscopic techniques in unilateral laminectomy for bilateral decompression (ULBD) for lumbar spinal stenosis. *BMC Muscoskelet Disord* 2024; 25(1): 713.
5. Hwa Eum J, Hwa Heo D, Son SK, et al. Percutaneous biportal endoscopic decompression for lumbar spinal stenosis: a technical note and preliminary clinical results. *J Neurosurg Spine* 2016; 24(4): 602–607.
6. Gibson JN and Waddell G. Surgery for degenerative lumbar spondylosis: updated Cochrane review. *Spine* 2005; 30(20): 2312–2320.
7. Lurie J and Tomkins-Lane C. Management of lumbar spinal stenosis. *Br Med J* 2016; 352: h6234.
8. Poletti CE. Central lumbar stenosis caused by ligamentum flavum: unilateral laminotomy for bilateral ligamentectomy: preliminary report of two cases. *Neurosurgery* 1995; 37(2): 343–347.
9. Fujimoto T, Taniwaki T, Tahata S, et al. Patient outcomes for a minimally invasive approach to treat lumbar spinal canal stenosis: is microendoscopic or microscopic decompressive laminotomy the less invasive surgery? *Clin Neurol Neurosurg* 2015; 131(2009): 21–25.
10. Minamide A, Yoshida M, Yamada H, et al. Clinical outcomes after microendoscopic laminotomy for lumbar spinal stenosis: a 5-year follow-up study. *Eur Spine J* 2014; 24(1): 396–403.
11. Merter A, Özyıldıran M, Shibayama M, et al. Comparison of 3 different endoscopic techniques for lumbar spinal stenosis: comprehensive radiological and clinical study. *Neurospine* 2025; 22(1): 276–285.
12. Kim SK, Kang SS, Hong YH, et al. Clinical comparison of unilateral biportal endoscopic technique versus open microdiscectomy for single-level lumbar discectomy: a multicenter, retrospective analysis. *J Orthop Surg Res* 2018; 13(1): 22.
13. Min WK, Kim JE, Choi DJ, et al. Clinical and radiological outcomes between biportal endoscopic decompression and

microscopic decompression in lumbar spinal stenosis. *J Orthop Sci* 2020; 25(3): 371–378.
14. Ito Z, Shibayama M, Nakamura S, et al. Clinical comparison of unilateral Biportal Endoscopic laminectomy versus microendoscopic laminectomy for single-level laminectomy: a single-center, retrospective analysis. *World Neurosurg* 2021; 148: e581–e588.
15. Yeung YK, Park CW, Jun SG, et al. Comparative cohort study for expansion of lateral recess and facet joint injury after biportal endoscopic ipsilateral decompression and contralateral decompression. *Asian Spine J* 2022; 16(4): 560–566.
16. Merter A, Özyıldıran M, Kurt F, et al. Bispectral index monitoring in endoscopic lumbar spine surgery: retrospective analysis of central nervous system complications. *World Neurosurg* 2025; 200: 124230.
17. Heo DH, Lee DC and Park CK. Comparative analysis of three types of minimally invasive decompressive surgery for lumbar central stenosis: Biportal endoscopy, uniportal endoscopy, and microsurgery. *Neurosurg Focus* 2019; 46(5): E9.
18. Nakamura S, Shibayama M, Ito F, et al. A new angled chisel for microendoscopic decompressive laminotomy. *Clin Spine Surg* 2017; 30(3): 173–178.
19. Koo TK and Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* 2016; 15(2): 155–163.
20. Winer BJ. *Statistical principles in experimental design*. 2nd ed. McGraw-Hill, 1971, pp. 283–293.
21. Zada G, Liu C and Apuzzo ML. Through the looking glass: optical physics, issues, and the evolution of neuroendoscopy. *World Neurosurg* 2012; 77(1): 92–102.
22. Liu CY, Wang MY and Apuzzo ML. The physics of image formation in the neuroendoscope. *Childs Nerv Syst* 2004; 20(11-12): 777–782.
23. Gaab MR. Instrumentation: endoscopes and equipment. *World Neurosurg* 2013; 79(2 Suppl): S14e11–S14e21.
24. Abbott R. History of neuroendoscopy. *Neurosurg Clin* 2004; 15(1): 1–7.
25. Perrone JM, Ames CD, Yan Y, et al. Evaluation of surgical performance with standard rigid and flexible-tip laparoscopes. *Surg Endosc* 2005; 19(10): 1325–1328.
26. Klangsin S, Ngaojaruwong N and Tintara H. Comparison of 30-degree and 0-degree laparoscopes in the visualisation of the inferior epigastric vessel, rectus abdominis muscle and bladder dome in gynaecologic laparoscopy. *J Obstet Gynaecol (Abingdon)* 2022; 42(6): 2203–2207.
27. Phillips BB, Azar FM, James HB, et al. *General principles of arthroscopy*. 14th ed. Elsevier, 2021, pp. 2540–2551.e2. Chapter 49.
28. Eun DC, Lee YH, Park JO, et al. A comparative analysis of Bi-Portal endoscopic spine surgery and unilateral laminotomy for bilateral decompression in multilevel lumbar stenosis patients. *J Clin Med* 2023; 12(3): 1033.
29. Park SR, Choi SR, Kim NH, et al. Biportal endoscopic decompression with maximized facet joint preservation for central to extraforaminal lumbar stenosis. *J Clin Med* 2025; 14(8): 2725.
30. Ostelo RW, Deyo RA, Stratford P, et al. Interpreting change scores for pain and functional status in low back pain: towards international consensus regarding minimal important change. *Spine* 2008; 33(1): 90–94.
31. Bedi A, Dines J, Dines DM, et al. Use of the 70° arthroscope for improved visualization with common arthroscopic procedures. *Arthroscopy* 2010; 26(12): 1684–1696.
32. Hoshino Y, Rothrauff BB, Hensler D, et al. Arthroscopic image distortion-part I: the effect of lens and viewing angles in a 2-dimensional in vitro model. *Knee Surg Sports Traumatol Arthrosc* 2016; 24(6): 2065–2071.
33. Mariani PP. The 45 degrees arthroscope: a forgotten scope in knee surgery. *Orthop Traumatol Surg Res* 2019; 105(4): 691–695.
34. Kekatpure AL, Adikrishna A, Sun JH, et al. Comparative analysis of visual field and image distortion in 30° and 70° arthroscopes. *Knee Surg Sports Traumatol Arthrosc* 2016; 24(7): 2359–2364.