International Journal of Clinical Medical Research

Effect of the decompression only compared to decompression with on lumbar degenerative spondylolisthesis: A meta-analysis

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Volume number 3
Issue number 4
Pages 113-129

10.61466/ijcmr3040003

Received: 10.03.2025
Accepted: 12.07.2025
Published: 13.07.2025
0nline: 01.08.2025

Abstract

Background: A meta-analysis study was completed to measure how to forecast the effect of the decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis.

Methods: Until October 2024, an inclusive literature study was accomplished, and 1865 related studies were reviewed. The 31 nominated studies encompassed 31678 participants with lumbar degenerative spondylolisthesis at the beginning of the study. The odds ratio (OR) and mean difference (MD) and 95% confidence intervals (CIs) were used to look at the outcome of the decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis dichotomous, or continuous methods with either a fixed or random model.

Results: In individuals with lumbar degenerative spondylolisthesis, decompression had significantly lower visual analog scale back score (MD, -0.57; 95% CI,-0.91- -0.23, p=0.001), visual analog scale leg score (MD, -0.26; 95% CI, -.49- -0.03, p=0.03), Oswestry Disability Index score (MD, -2.42; 95% CI, -4.75- -0.08, p=0.04), operation time (MD, -82.60; 95% CI, -130.06- -35.14, p<0.001) intraoperative blood loss (MD, -261.93; 95% CI, -360.49- -163.36, p<0.001), and length of hospital stay (MD, -20.09; 95% CI, -29.55- -10.64, p<0.001) compared to decompression with fusion treatment. However, no significant difference was found between decompression and decompression with fusion treatment in European Quality of Life-5 Dimensions score (MD, -0.01; 95% CI, -0.04-0.01, p=0.28) Short-Form 36 physical component summary (MD, -0.73; 95% CI, -2.70-1.24, p=0.47), Short-Form 36 mental component summary score (MD, 0.08; 95% CI, -2.94-3.10, p=0.96), patient satisfaction (OR, 0.52; 95% CI, 0.25-1.09, p=0.08), overall complication rate (OR, 0.92; 95% CI, 0.68-1.26, p=0.61), and overall reoperation rate (OR, 1.34; 95% CI, 0.85-2.13, p=0.21) in individuals with lumbar degenerative spondylolisthesis.

Conclusions: In individuals with lumbar degenerative spondylolisthesis, decompression had significantly lower visual analog scale back score, visual analog scale leg score, Oswestry Disability Index score, operation time, intraoperative blood loss and length of hospital stay, however, no significant difference was in European Quality of Life-5 Dimensions score Short-Form 36 physical component summary, Short-Form 36 mental component summary score, patient satisfaction overall complication rate and overall reoperation compared to decompression with fusion treatment. To validate this finding more studies are required, and care is essential to be implemented when interconnecting with its values, since many comparisons had law number of selected studies.

Keywords: lumbar degenerative spondylolisthesis; visual analog scale back score; visual analog scale leg score; Oswestry Disability Index score; fusion; decompression

Introduction

One of the most prevalent degenerative spine conditions disturbing elderly is lumbar degenerative spondylolisthesis, which is linked to radiculopathy, neurologic claudication, and/or mechanical low back pain as a consequence of spinal stenosis. [1, 2] In general community, lumbar degenerative spondylolisthesis affects about 4.1% of people. [3] According to the findings of the Spine Patient Outcomes Research Trial, surgical intervention considerably enhanced these patients' pain and function more than nonsurgical intervention did. For lumbar degenerative spondylolisthesis, [4, 5] decompression with instrumented or noninstrumented fusion is considered the gold standard procedure and is frequently performed. [4-7] From 1999 to 2011, decompression without fusion was used to treat about 5% of patients with lumbar degenerative spondylolisthesis. [7] For lumbar degenerative spondylolisthesis, a number of meta-analyses comparing the surgical results of decompression alone versus decompression plus fusion have been published throughout past 30 years. The majority of published meta-analyses came to the conclusion that decompression and fusion produced superior clinical outcomes than decompression alone, based on qualitative evaluations of earlier research. [1, 3, 8, 9] Some trials' findings, which ran counter to the majority of earlier research, demonstrated that fusion did not offer much more benefit for patients with stable lumbar degenerative spondylolisthesis and could perhaps be considered an unnecessary and conservative course of treatment. [10, 11] We think that in order to update the evidence and validate the findings, a quantitative analysis using a statistical combination of current studies, comprising most recent randomized controlled trials, is required. In order to examine the clinical results, complications, reoperations, and other perioperative data of patients with lumbar degenerative spondylolisthesis, we performed a meta-analysis comparing decompression alone with decompression with fusion.

Objectives

We used a meta-analysis to assess effect of decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis.

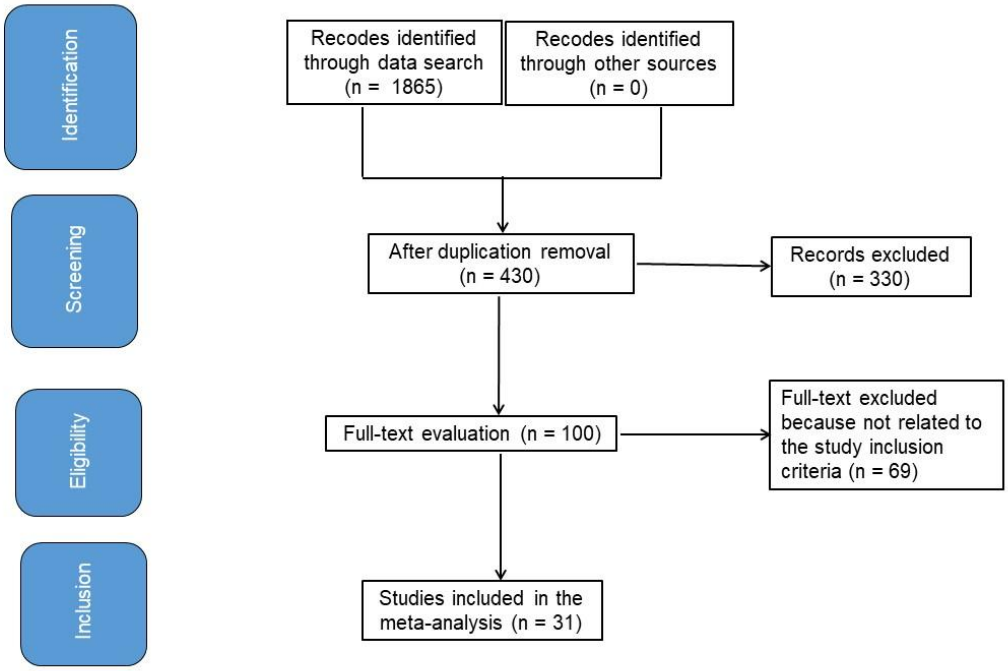
Methods

Eligibility criteria

To deliver an indication of the studies that presented effect of decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis. [12]

Information sources

The full investigation is depicted in Figure 1.



Figur

e 1 shows a procedure flowchart for the research.

The literature was included in the study if following inclusion criteria were met:
1. The research was observational, prospective, retrospective, or randomized controlled trial (RCT).
2. The persons picked for examination had lumbar degenerative spondylolisthesis.
3. Fusion was included into the study.
4. The study completed a difference about effect of decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis.
Studies that did not check the outcome of the decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis, studies on individuals with decompression with fusion treatment only, and studies with no comparison significance were also removed. [13]

Search strategy

The PICOS perspective was used to identify a search protocol procedure, which we characterized as follows: the "population" contained persons with lumbar degenerative spondylolisthesis, P; decompression was the "intervention" and the "comparison" involved comparison between decompression to decompression with fusion treatment' variables; the "outcome" was the effect on visual analog scale back score, visual analog scale leg score, and Oswestry Disability Index score and other permanents; and the "research design" was without boundaries. [14]
Using a set of keywords and other terms as shown in Table 1, we conducted a comprehensive search of the Cochrane Library, Google Scholar, Embase, PubMed, and OVID databases through October 2024. To stop the addition of a study that was incapable to institute a connection among effect of decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis, the repetitions of papers were removed, The remaining ones were compiled into an EndNote file, and their abstracts and titles were evaluated once more.

Selection process

The process that followed epidemiological proclamation was then arranged and evaluated using the meta-analysis method. [15]

Data collection process

Initial author's name, research data, research year, country or location, population type, categories, quantitative and qualitative estimating methodologies, data sources, consequence estimation, medical and treatment physiognomies, and statistical analysis were some of criteria used to collect data. [16]

Data items

When a study produced diverse values, we individually collected the data found on an evaluation of effect of decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis.

Research risk of bias assessment

The possibility of bias in the research and caliber of methods utilized in publications selected for further analysis were examined by two writers. Each test's methodology was objectively reviewed by two authors.

Effect measures

Sensitivity analysis was restricted to studies that measured effect of decompression only compared to decompression with fusion on lumbar degenerative spondylolisthesis. A subclass analysis was utilized to compare the relationship between decompression and decompression with fusion in diverse patients' variables in lumbar degenerative spondylolisthesis individuals' sensitivity.

Synthesis methods

The 95% CI, mean difference (MD), and odds ratio (OR) were calculated using a continuous and dichotomous approach and a random or fixed-effect model. To calculate the I2 index, a range of 0 to 100% was employed. No, low, moderate, and high heterogeneity were seen at 0%, 25%, 50%, and 75% of the data, respectively. [17] Additional structures that exhibit a high degree of resemblance with the relevant inquiry were also explored in order to guarantee that the identical model was employed. If I2 was less than 50%, the fixed-effect was chosen; if not, the random effect was applied. [17] By dividing the initial estimation into the previously designated consequence groups, a subclass analysis was carried out. The analysis used a p-value of less than 0.05 to determine if changes between subcategories were statistically significant. [18]

Reporting bias assessment

The Egger regression test and funnel plots, which show the logarithm of the ORs or MDs against their standard errors, were two quantitative and qualitative techniques used to assess bias in studies. $p \geq 0.05$ indicated the presence of inquiry bias. [19]

Table 1. Database Search Strategy for inclusion of examinations

Database	Search strategy
Google Scholar	#1 "lumbar degenerative spondylolisthesis" OR "visual analog scale back score" #2 "visual analog scale leg score" OR "Oswestry Disability Index score" OR "fusion" OR "fusion" #3 #1 AND #2
Embase	#1 'lumbar degenerative spondylolisthesis' /exp OR 'visual analog scale back score' /exp OR 'fusion' #2 'visual analog scale leg score'/exp OR 'Oswestry Disability Index score'/exp OR 'fusion' #3 #1 AND #2
Cochrane library	#1 (lumbar degenerative spondylolisthesis):ti,ab,kw OR (visual analog scale back score):ti,ab,kw OR (fusion):ti,ab,kw (Word variations have been searched) #2 (visual analog scale leg score):ti,ab,kw OR (Oswestry Disability Index score):ti,ab,kw OR (fusion):ti,ab,kw (Word variations have been searched) #3 #1 AND #2
Pubmed	#1 "lumbar degenerative spondylolisthesis"[MeSH] OR "visual analog scale back score"[MeSH] OR "fusion" [All Fields] #2 "visual analog scale leg score"[MeSH Terms] OR "Oswestry Disability Index score"[MeSH] OR "decompression "[All Fields] #3 #1 AND #2
OVID	#1 "lumbar degenerative spondylolisthesis"[All Fields] OR "visual analog scale back score" [All Fields] OR "fusion" [All Fields] #2 "visual analog scale leg score"[All fields] OR "Oswestry Disability Index score"[All Fields] or "decompression"[All Fields] #3 #1 AND #2

Certainty assessment

We used two-tailed testing to examine each p-value. Reviewer Manager Version 5.3 (The Nordic Cochrane Centre, the Cochrane Collaboration, Copenhagen, Denmark) was used to construct graphs and statistical analysis.

Results

31 publications that met the enclosure criteria and were published between 1991 and 2024 were selected for the study from a total of 1865 related studies. [10, 11, 20-48] The results of these studies are available in Table 2. There were 31678 people with lumbar degenerative spondylolisthesis at the start of the investigations that were used. Sample size of chosen studies ranged from 34 to 20100 individuals.

As illustrated in Figures 2-7, in individuals with lumbar degenerative spondylolisthesis, decompression had significantly lower visual analog scale back score (MD, -0.57; 95% CI,-0.91- -0.23, p=0.001) with moderate heterogeneity (I2 = 64%), visual analog scale leg score (MD, -0.26; 95% CI, -.49- -0.03, p=0.03) with no heterogeneity (I2 = 0%), Oswestry Disability Index score (MD, -2.42; 95% CI, -4.75- -0.08, p=0. 04) with moderate heterogeneity (I2 = 67%), operation time (MD, -82.60; 95% CI, -130.06- -35.14, p<0.001) with high heterogeneity (I2 = 99%), intraoperative blood loss (MD, -261.93; 95% CI, -360.49- -163.36, p<0.001) with high heterogeneity (I2 = 97%), and length of hospital stay (MD, -20.09; 95% CI, -29.55- -10.64, p<0.001) with high heterogeneity (I2 = 100%) compared to decompression with fusion treatment.

However, no significant difference was found between decompression and decompression with fusion treatment in European Quality of Life-5 Dimensions score (MD, -0.01; 95% CI, -0.04-0.01, p=0.28) with no heterogeneity (I2 = 22%), Short-Form 36 physical component summary (MD, -0.73; 95% CI, -2.70-1.24, p=0.47) with low heterogeneity (I2 = 40%), Short-Form 36 mental component summary score (MD, 0.08; 95% CI, -2.94-3.10, p=0.96) with

moderate heterogeneity (I2 = 67%), patient satisfaction (OR, 0.52; 95% CI, 0.25-1.09, p=0.08) with moderate heterogeneity (I2 = 69%), overall complication rate (OR, 0.92; 95% CI, 0.68-1.26, p=0.61) with no heterogeneity (I2 = 0%), and overall reoperation rate (OR, 1.34; 95% CI, 0.85-2.13, p=0.21) with moderate heterogeneity (I2 = 58%) in individuals with lumbar degenerative spondylolisthesis as shown in Figures 8-13.

	Depression			Depression and fusion				Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	Year
Kleinstueck, 2012	1.7	3.4	56	2.9	2.9	157	6.4%	-1.20 [-2.20, -0.20]	2012
Park, 2012	1.6	3.2	20	4.2	2.6	25	3.0%	-2.60 [-4.33, -0.87]	2012
Sato negative, 2015	1.1	3	18	2.9	2.6	20	2.9%	-1.80 [-3.59, -0.01]	2015
Sato positive, 2015	1.9	3.6	33	1.7	3	69	4.1%	0.20 [-1.22, 1.62]	2015
Sigmundsson B less thenL, 2015	2.7	3.1	76	3.4	2.7	148	7.8%	-0.70 [-1.52, 0.12]	2015
Sigmundsson B more then L, 2015	0.8	2.8	73	2.2	2.8	130	8.0%	-1.40 [-2.20, -0.60]	2015
Försth, 2016	3.7	2.9	66	2.8	3	67	6.4%	0.90 [-0.10, 1.90]	2016
Austevoll, 2017	3	2.9	216	3.5	2.8	223	10.7%	-0.50 [-1.03, 0.03]	2017
Chan B, 2019	1.5	20.7	71	4.7	3.2	72	0.5%	-3.20 [-8.07, 1.67]	2019
Kayalar, 2019	2.74	0.3	50	2.88	0.5	50	14.1%	-0.14 [-0.30, 0.02]	2019
Kim, 2020	2.5	1.5	23	3.9	1.7	24	7.1%	-1.40 [-2.32, -0.48]	2020
de Dios, 2022	3.75	2.73	412	3.85	2.83	305	12.0%	-0.10 [-0.51, 0.31]	2022
Karlsson, 2022	3.5	2.8	25	3.8	3	42	4.1%	-0.30 [-1.72, 1.12]	2022
Karlsson, 2024	3.3	2.9	63	3.8	3.3	59	5.7%	-0.50 [-1.61, 0.61]	2024
Kgomotso, 2024	3.35	2.92	100	3.66	3.23	89	7.3%	-0.31 [-1.19, 0.57]	2024
Total (95% CI)			**1302**			**1480**	**100.0%**	**-0.57 [-0.91, -0.23]**	

Heterogeneity: Tau² = 0.21; Chi² = 38.64, df = 14 (P = 0.0004); I² = 64%
Test for overall effect: Z = 3.30 (P = 0.0010)

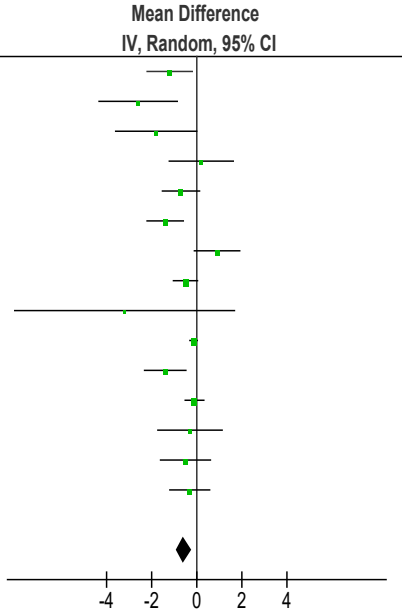


Figure 2. The decompression compared to decompression with fusion treatment's forest plot influence on visual analog scale back score in participants with lumbar degenerative spondylolisthesis

	Depression			Depression and fusion				Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI	Year
Kleinstueck, 2012	3.1	3	56	3.9	3.4	157	6.1%	-0.80 [-1.75, 0.15]	2012
Park, 2012	5.4	2.4	20	5.5	1.8	25	3.4%	-0.10 [-1.37, 1.17]	2012
Lattig negative, 2015	3.4	3.2	18	3.5	3.4	20	1.2%	-0.10 [-2.20, 2.00]	2015
Lattig positive, 2015	3.7	3.5	33	3.8	3.4	157	3.2%	-0.10 [-1.41, 1.21]	2015
Sigmundsson B less thenL, 2015	2	3.6	76	2.6	3.4	148	5.7%	-0.60 [-1.58, 0.38]	2015
Sigmundsson B more then L, 2015	3.6	3.6	73	4.3	3.4	130	5.3%	-0.70 [-1.71, 0.31]	2015
Försth, 2016	3.6	3.3	66	3.2	3.1	67	4.6%	0.40 [-0.69, 1.49]	2016
Austevoll, 2017	3.3	3.1	212	3.7	3.2	215	15.3%	-0.40 [-1.00, 0.20]	2017
Chan B, 2019	3.8	3.7	71	4.5	3.9	72	3.5%	-0.70 [-1.95, 0.55]	2019
Kim, 2020	4.7	1.6	23	4	1.5	24	6.9%	0.70 [-0.19, 1.59]	2020
Karlsson, 2022	2.7	3	25	2.9	2.6	42	2.7%	-0.20 [-1.61, 1.21]	2022
de Dios, 2022	3.91	2.84	412	4.18	3.21	305	26.7%	-0.27 [-0.72, 0.18]	2022
Karlsson, 2024	3.2	3	63	3.4	3.1	59	4.7%	-0.20 [-1.28, 0.88]	2024
Kgomotso, 2024	2.83	2.38	100	3.08	2.64	89	10.5%	-0.25 [-0.97, 0.47]	2024
Total (95% CI)			**1248**			**1510**	**100.0%**	**-0.26 [-0.49, -0.03]**	

Heterogeneity: Chi² = 9.19, df = 13 (P = 0.76); I² = 0%
Test for overall effect: Z = 2.18 (P = 0.03)

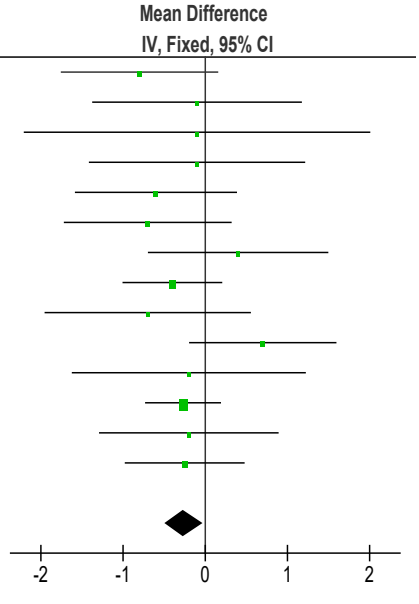


Figure 3. The decompression compared to decompression with fusion treatment's forest plot influence on visual analog scale leg score in participants with lumbar degenerative spondylolisthesis

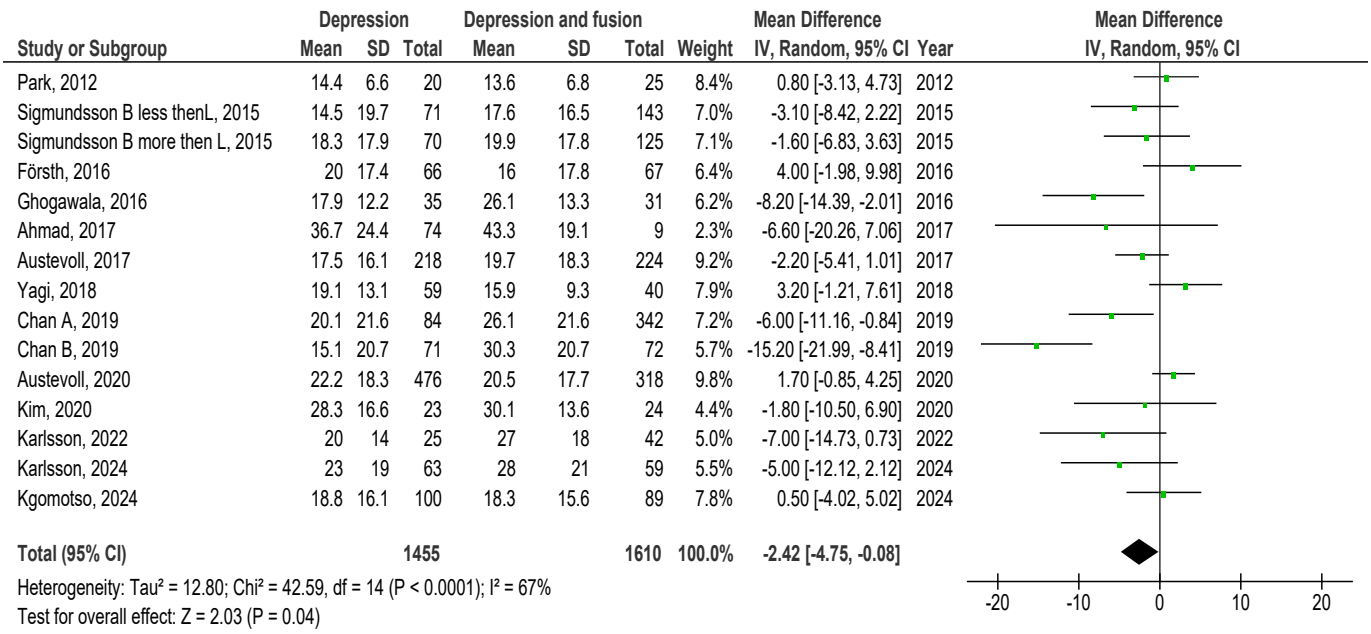


Figure 4. The decompression compared to decompression with fusion treatment's forest plot influence on Oswestry Disability Index score in participants with lumbar degenerative spondylolisthesis

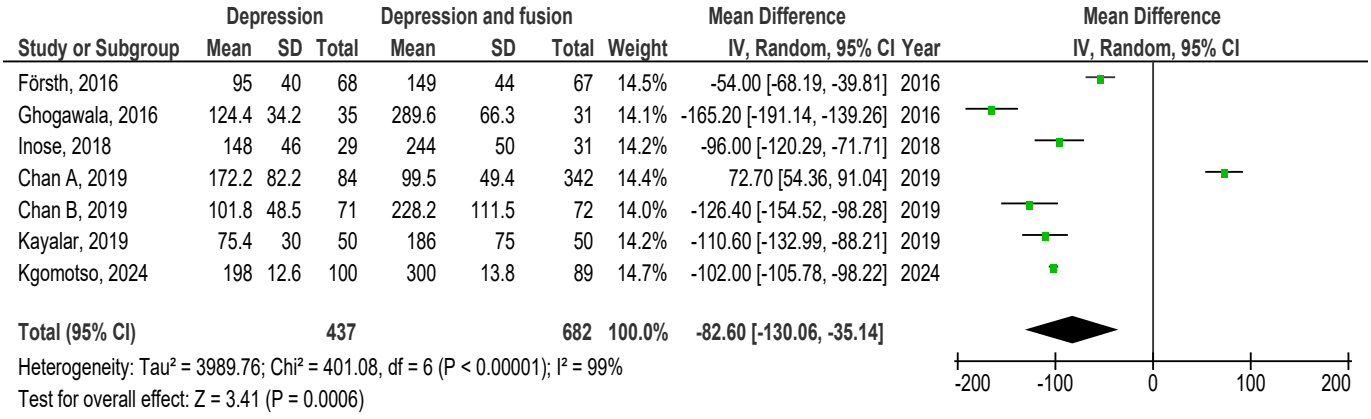


Figure 5. The decompression compared to decompression with fusion treatment's forest plot influence on operation time in participants with lumbar degenerative spondylolisthesis

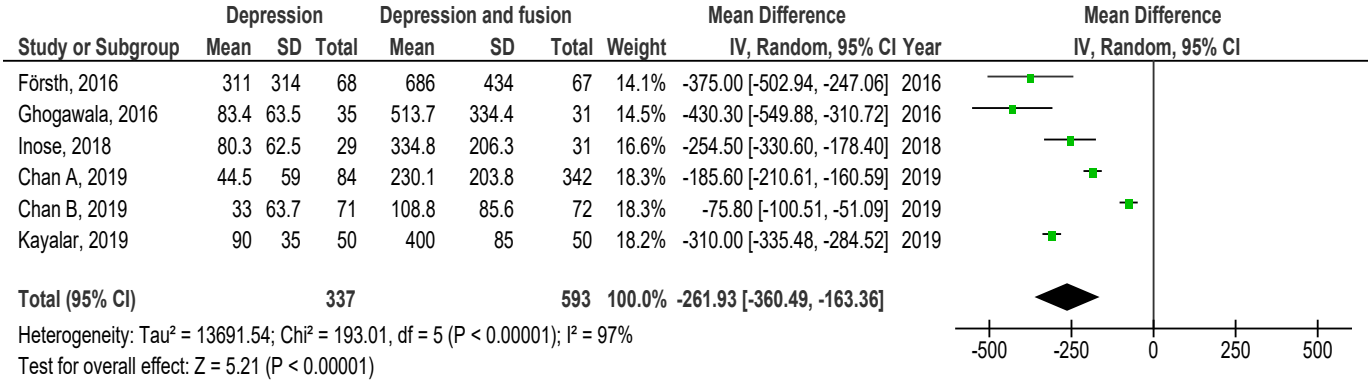


Figure 6. The decompression compared to decompression with fusion treatment's forest plot influence on intraoperative blood loss in participants with lumbar degenerative spondylolisthesis

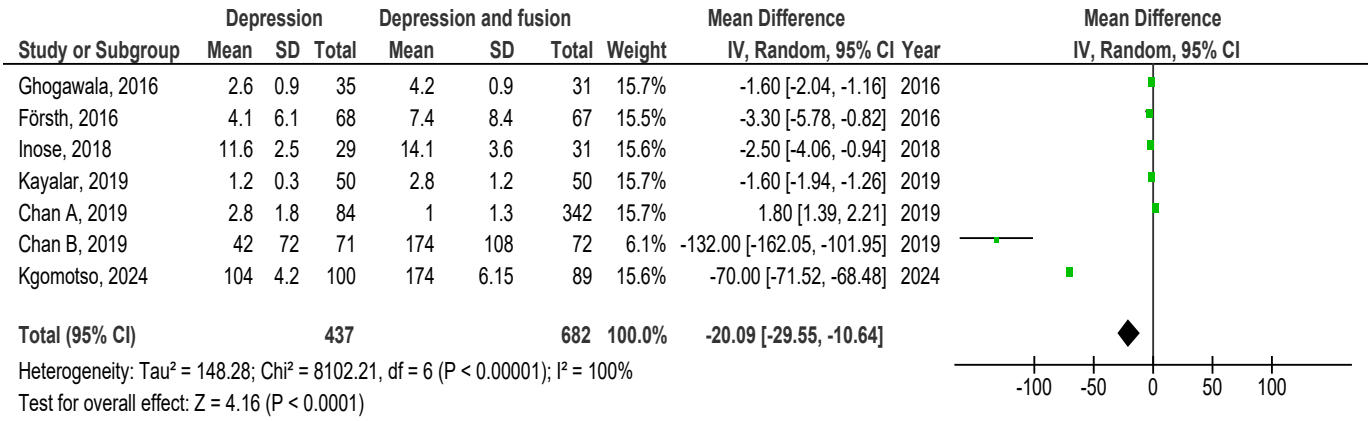


Figure 7. The decompression compared to decompression with fusion treatment's forest plot influence on length of hospital stay stay in participants with lumbar degenerative spondylolisthesis

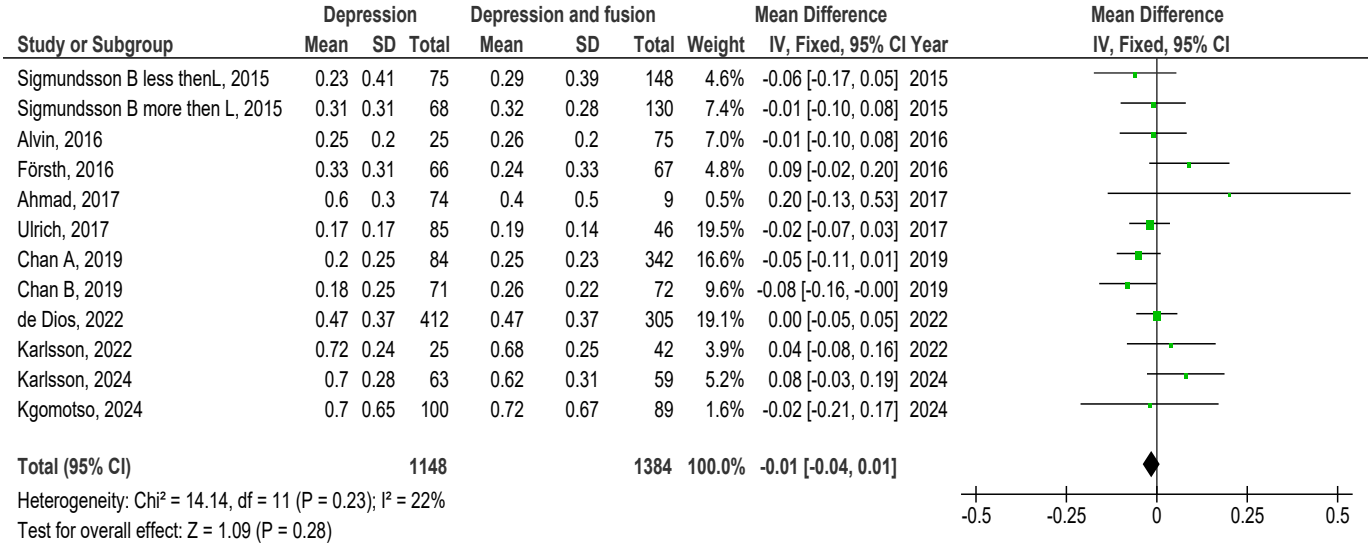


Figure 8. The decompression compared to decompression with fusion treatment's forest plot influence on European Quality of Life-5 Dimensions score in participants with lumbar degenerative spondylolisthesis

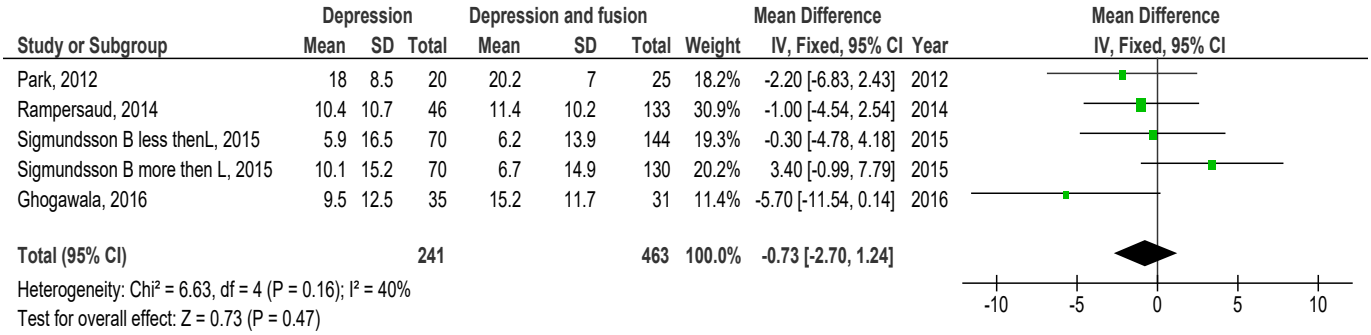


Figure 9. The decompression compared to decompression with fusion treatment's forest plot influence on Short-Form 36 physical component summary score in participants with lumbar degenerative spondylolisthesis

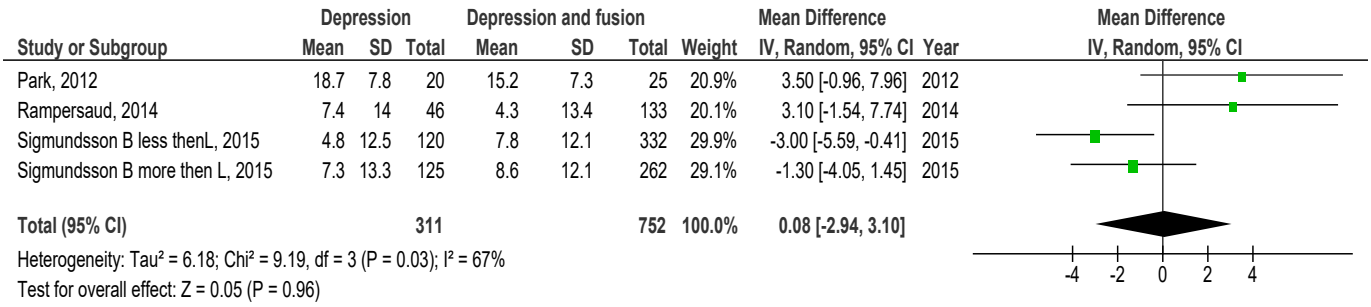


Figure 10. The decompression compared to decompression with fusion treatment's forest plot influence on Short-Form 36 mental component summary score in participants with lumbar degenerative spondylolisthesis

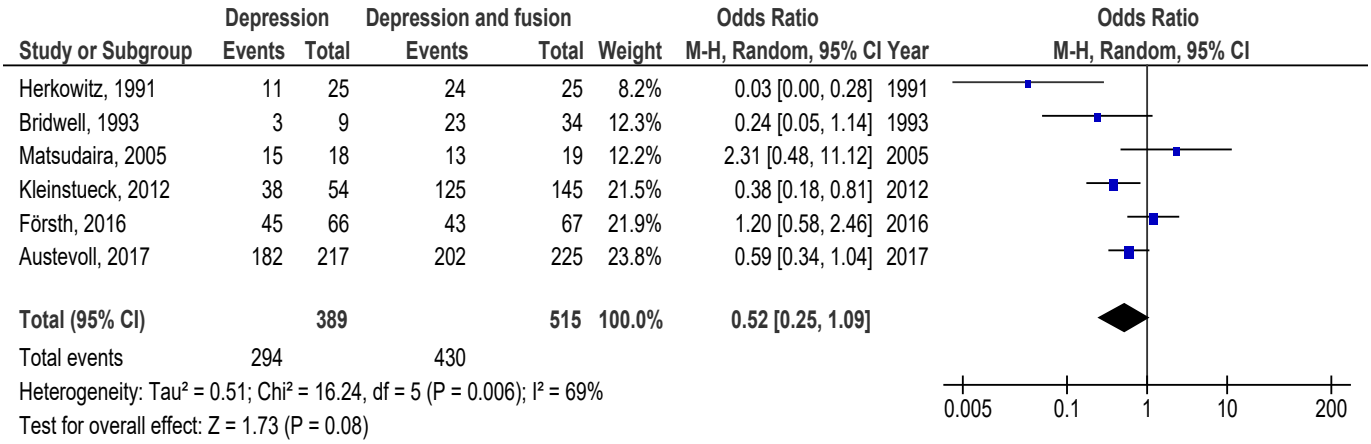


Figure 11. The decompression compared to decompression with fusion treatment's forest plot influence on patient satisfaction in participants with lumbar degenerative spondylolisthesis

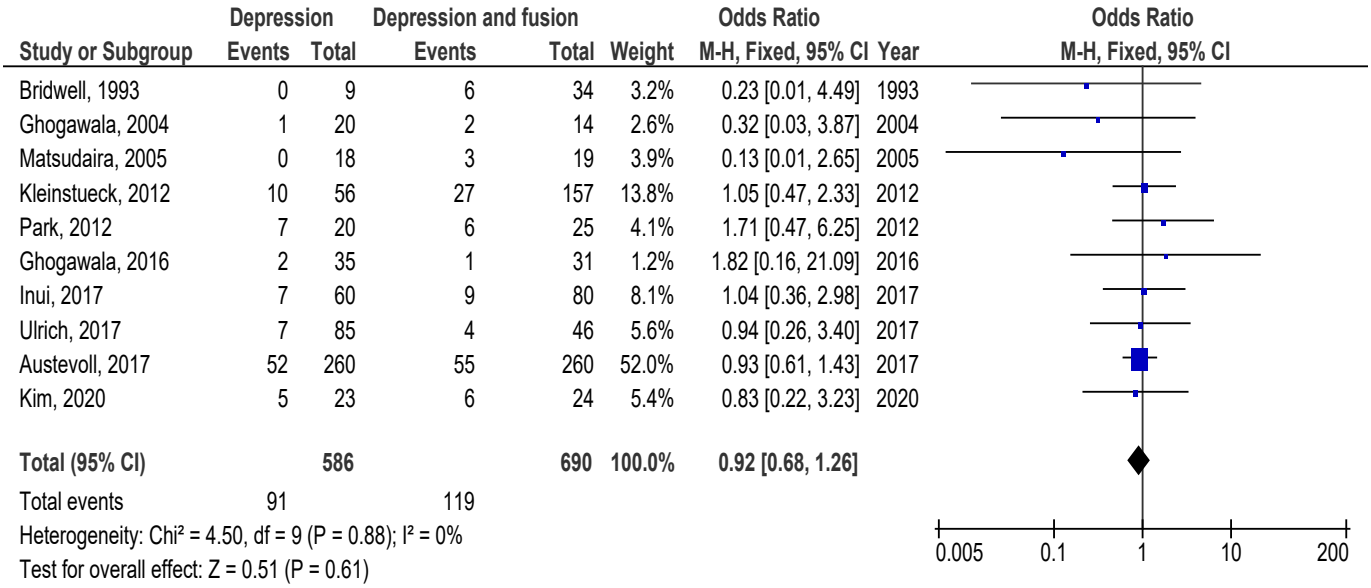


Figure 12. The decompression compared to decompression with fusion treatment's forest plot influence on overall complication rate in participants with lumbar degenerative spondylolisthesis

Table 2. Qualities of the chosen studies for the meta-analysis

Study	Country	Total	Depression	Depression and fusion	Study design	Age, years	Length of follow-up
Herkowitz, 1991 [20]	USA	50	25	25	RCT	1) 69±5 2) 68±5	24 months
Bridwell, 1993 [21]	USA	43	9	34	RCT	1) 65±9 2) 67±8	36 months
Ghogawala, 2004 [22]	USA	34	20	14	RCT	1) 66±5 2) 66±5	24 months
Matsudaira, 2005 [23]	Japan	37	18	19	cohort studies	1) 62±6 2) 63±6	60 months
Park, 2012 [24]	Korea	45	20	25	RCT	1) 64±7 2) 62±7	36 months
Kleinstueck, 2012 [25]	Switzerland	213	56	157	RCT	1) 63±9 2) 61±8	24 months
Kim, 2012 [26]	Canada	115	57	58	cohort studies	1) 65±7 2) 67±6	24 months
Rampersaud, 2014 [27]	USA	179	46	133	RCT	1) 65±8 2) 64±5	60 months
Sigmundsson, 2015 [28]	Sweden	427	149	278	cohort studies	1) 66±8 2) 67±8	12 months
Sato, 2015 [29]	Japan	163	74	89	RCT	1) 69±8 2) 69±9	30 months
Lattig, 2015 [30]	Switzerland	228	51	177	cohort studies	1) 66±7 2) 65±8	60 months
Försth, 2016 [10]	Sweden	133	66	67	RCT	1) 69±5 2) 70±7	36 months
Ghogawala, 2016 [11]	USA	66	35	31	cohort studies	1) 67±9 2) 68±8	60 months
Alvin, 2016 [31]	USA	100	25	75	cohort studies	1) 64±7 2) 63±8	48 months
Ahmad, 2017 [32]	UK	83	74	9	RCT	1) 66±8 2) 67±9	24 months
Ulrich, 2017 [33]	Switzerland	131	85	46	RCT	1) 67±7 2) 65±7	48 months
Inui, 2017 [34]	Japan	140	60	80	cohort studies	1) 69±8 2) 70±9	36 months

Austevoll, 2017 [35]	Norway	439	216	223	RCT	1) 65±5 2) 64±6	60 months
Inose, 2018 [36]	Japan	60	29	31	RCT	1) 70±7 2) 69±9	48 months
Vorhies, 2018 [37]	USA	20100	2074	18026	cohort studies	1) 68±5 2) 69±6	36 months
Yagi, 2018 [38]	Japan	99	59	40	RCT	1) 65±9 2) 63±8	24 months
Chan A, 2019 [39]	USA	426	84	342	cohort studies	1) 67±5 2) 66±5	36 months
Pieters, 2019 [40]	China	6188	5699	489	RCT	1) 65±7 2) 64±9	24 months
Kayalar, 2019 [41]	Turkey	100	50	50	cohort studies	1) 65±5 2) 67±6	24 months
Chan B, 2019 [42]	USA	143	71	72	RCT	1) 67±10 2) 67±9	60 months
Kim, 2020 [43]	Korea	47	23	24	RCT	1) 69±10 2) 70±8	36 months
Austevoll, 2020 [44]	Norway	794	476	318	cohort studies	1) 68±8 2) 67±9	12 months
de Dios, 2022 [45]	Sweden	717	412	305	RCT	1) 69±8 2) 66±10	12 months
Karlsson, 2022 [46]	Sweden	67	25	42		1) 68±7 2) 66±6	48 months
Karlsson, 2024 [47]	Sweden	122	63	59	RCT	1) 65±7 2) 67±5	36 months
Kgomotso, 2024 [48]	Norway	189	100	89	RCT	1) 67±5 2) 68±7	50 months
	Total	**31678**	**10251**	**21427**			

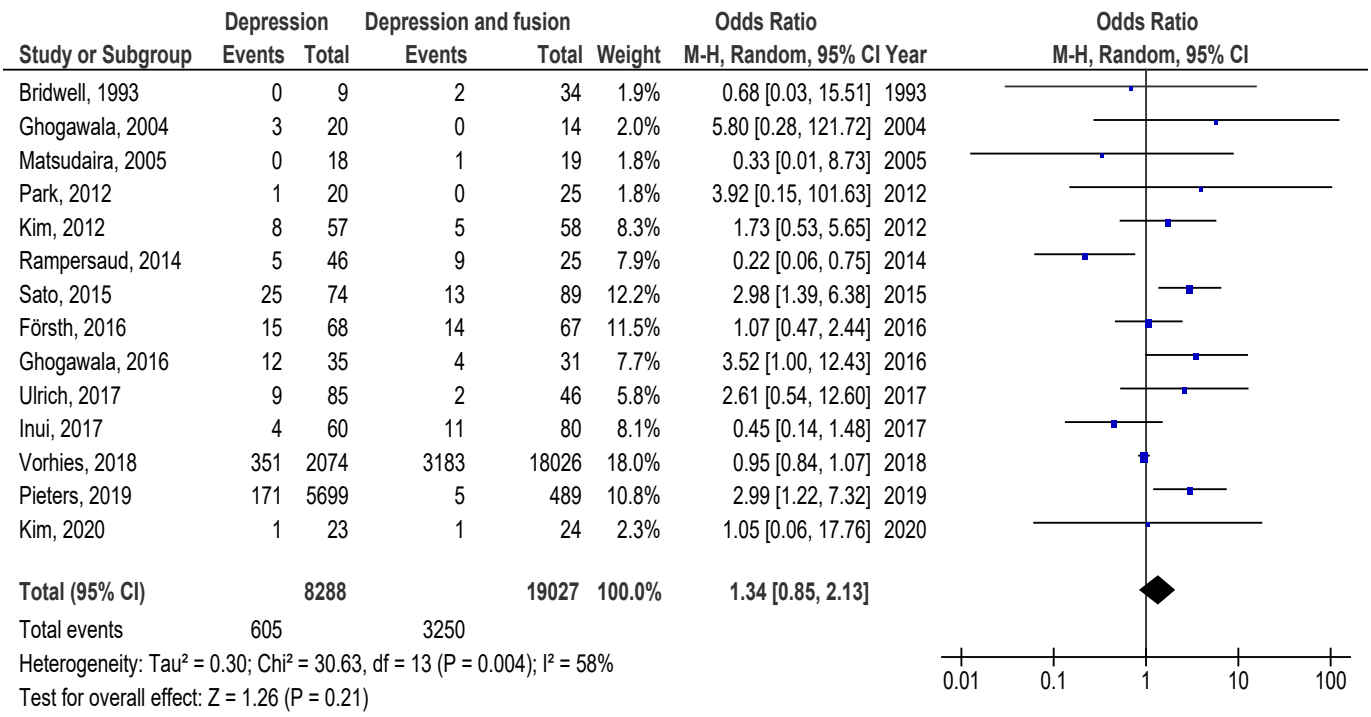


Figure 13. The decompression compared to decompression with fusion treatment's forest plot influence on overall reoperation rate in participants with lumbar degenerative spondylolisthesis

The use of stratified models to observe the possessions of certain constituents was not likely owing to the lack of data, such as gender, ethnicity, and age, on comparison consequences. No indication of study bias was found using the visual clarification of funnel plot and quantitative Egger regression test (p = 0.88). Nonetheless, it was demonstrated that bulk of the relevant RCTs had subpar technical quality and that there was no bias in the selective reporting.

Discussions

The studies that were used for the meta-analysis began with 31678 people who had lumbar degenerative spondylolisthesis. [10, 11, 20-48] In individuals with lumbar degenerative spondylolisthesis, decompression had significantly lower visual analog scale back score, visual analog scale leg score, Oswestry Disability Index score, operation time, intraoperative blood loss and length of hospital stay compared to decompression with fusion treatment. However, no significant difference was found between decompression and decompression with fusion treatment in European Quality of Life-5 Dimensions score Short-Form 36 physical component summary, Short-Form 36 mental component summary score, patient satisfaction overall complication rate and overall reoperation in individuals with lumbar degenerative spondylolisthesis. More research is necessary to confirm this discovery, and care must be used while interacting with its values, since many comparisons had law number of selected studies. The significance of the reviewed assessments would be affected by that.

Decompression was thought to alleviate radiculopathy and neurologic claudication in lumbar degenerative spondylolisthesis, while fusion was thought to alleviate back discomfort and lower the danger of iatrogenic instability brought on by decompression. [6, 28] According to a questionnaire survey study, back discomfort and the incidence of motion on flexion/extension radiographs were two main variables that led to the decision to have fusion surgery.[6] To appraise the clinical consequences following therapy for lumbar degenerative spondylolisthesis, no particular clinical parameter or questionnaire is advised. Three health-connected quality-of-life questionnaires, Visual Analog Scale, Oswestry Disability Index, and Short-Form 36. [49-52], are frequently used to assess lumbar spine surgery. It was generally accepted that a difference of at least 1 points on Visual Analog Scale was clinically significant. [52-54] Visual Analog Scale-back and Visual Analog Scale-leg scores did not meet minimal clinically relevant difference, although being statistically significant. There was no clinically significant difference in the two groups' Visual Analog Scale scores. Other health-related quality-of-life questionnaires, e.g. Oswestry Disability Index score, European

Quality of Life-5 Dimensions score, short-Form 36 physical component summary score, and Short-Form 36 mental component summary score, also showed no discernible differences between the two groups in patient satisfaction or change. In general, we thought that decompression by itself could produce comparable clinical results to decompression with fusion, particularly for patients whose flexion/extension radiographs showed no dynamic instability. [2, 8] Two randomized controlled trials for lumbar degenerative spondylolisthesis conducted in the 1990s revealed that individuals who had concurrent fusion had noticeably better clinical consequences than those who just had decompression.[20, 21] These investigations demonstrated that patients without fusion had a higher incidence of postoperative advancement of spondylolisthesis at the surgical region, which was linked to poor clinical outcomes. Following an aggressive laminectomy, concurrent fusion may ensure enough decompression and avoid inherent spinal stability. According to Spine Patient Outcomes Research Trial's 4-year results, there were no appreciable differences in the Short-Form 36 and Oswestry Disability Index scores between the three fusion techniques (posterolateral fusion versus interbody fusion pedicle screw) for patients with lumbar degenerative spondylolisthesis and spinal stenosis. [55] In contrast to a noninstrumented fusion group (67.27%), instrumented fusion groups also observed greater solid fusion rates (85.29% and 87.04%). This outcome was in line with earlier meta-analyses. [56, 57] This may help to explain why the fusion procedure employed in decompression and fusion group involved utilization of instruments in all but one of the included investigations. More discussion will center on whether fusion is still required for individuals with lumbar degenerative spondylolisthesis in light of the release of two randomized controlled trials, [10, 11] Ghogawala et al. [11] discovered that at 2, 3, and 4 years following surgery, the more expensive method of decompression and fusion was linked to a marginally higher clinically significant improvement in Short-Form 36 score than was decompression alone. However, there was no significant difference in secondary consequence, Oswestry Disability Index score, between treatment groups. Decompression and fusion surgery was expensive, but it did not significantly enhance primary results (Oswestry Disability Index) or any other secondary outcomes, according to Forsth et al. [10] In the past 10 years, additional research has indicated that for certain individuals with lumbar degenerative spondylolisthesis, decompression alone was just as beneficial as decompression with fusion. [10, 11, 27-30, 32-48] For certain patients, decompression alone was thought to be more cost-effective than instrumented fusion because adding fusion was more expensive. [26, 31] Due to significant heterogeneity, which has been shown in numerous research, it is challenging to compare problems between the two groups in detail. Contrary to the majority of earlier research, we discovered in this meta-analysis that there was no significant difference in complication and reoperation rates across treatment groups. [11, 21, 23, 58] Following a qualitative analysis of included studies, we discovered that most frequent consequence in the decompression group was residue or return of symptoms, which was mostly brought on by postoperative instability. On the other hand, the decompression and fusion group experienced higher neighboring segmental disease and implant-related problems. Due to a lack of data, it was not able to quantitatively evaluate differences of each particular problem between two groups. Patients who are older and have a greater grade of spondylolisthesis were thought to be at increased risk for complications, and they should receive additional care. [3, 59] According to the included studies, adjacent segmental diseases and implant-related issues accounted for the majority of reoperations in the decompression and fusion group, while same segmental diseases (such as disc herniation and recurrent stenosis) were common causes of reoperations in decompression group. [11, 29] Long-term monitoring, however, indicates that while spinal fusion has little effect on clinical result, it speeds up the degeneration of the nearby segment. [60] It appears that surgeons may incorrectly ascribe the common cause of poor outcomes following fusion surgery to illnesses of the surrounding segments.

Several outcomes showed high heterogeneity (e.g., operation time $I^2 = 99\%$, intraoperative blood loss $I^2 = 97\%$). This reduced the reliability of pooled estimates. Heterogeneity may also come from the different types of surgeons, surgical methods, and criteria used to include or exclude research. After that, both instrumented and non-instrumented fusions were added to the fusion group. Non-instrumented fusions, which are often used to fix instability, may not have as many problems as instrumented fusions. [44] Heterogeneity and bias are also caused by the fact that different studies use different meanings, tools, and follow-up methods to track outcomes such as pain and complications. A standard review plan to measure results needs to be made right away.

Limitations

The primary drawback is that the majority of the encompassed studies lacked information on lumbar stability, degree of slippage, and patients' primary symptom. This restriction prevented us from performing additional

stratified analysis, which likely had an impact on the results of various surgical procedures. Therefore, we are unable to identify which patient groups would profit from further fusion. The majority of comprised studies were nonRCTs. Further randomized controlled trial studies or well accompanied observational studies with more patients must be conducted, even though the comprised studies were of reasonably high quality based on Newcastle-Ottawa Scale assessment. Furthermore, due to a lack of evidence pertaining to radiographic findings, we were unable to compare the two therapy groups on a radiographic level. There may have been a variety bias as some of researchers selected for meta-analysis were left out. However, the eliminated studies failed to meet the necessities to be encompassed in the meta-analysis. Furthermore, we lacked sufficient data to assess the potential influence of age, sex, and race on outcomes. The inclusion of inaccurate or partial data from past studies might have led to an increase in bias. In addition to their nutritional state, the participants' age, gender, race, and nutrition were probably biassed. Incomplete data and unreported research may result in values that are inadvertently skewed.

Conclusions

In individuals with lumbar degenerative spondylolisthesis, decompression had significantly lower visual analog scale back score, visual analog scale leg score, Oswestry Disability Index score, operation time, intraoperative blood loss and length of hospital stay compared to decompression with fusion treatment. However, no significant difference was found between decompression and decompression with fusion treatment in European Quality of Life-5 Dimensions score Short-Form 36 physical component summary, Short-Form 36 mental component summary score, patient satisfaction overall complication rate and overall reoperation in individuals with lumbar degenerative spondylolisthesis. More research is wanted to confirm this discovery, and care must be used while interacting with its values, since many comparisons had law number of selected studies. The significance of the reviewed assessments would be affected by that.

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