Decompression alone versus interspinous/interlaminar device placement for degenerative lumbar pathologies: Systematic Review and Meta-Analysis

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Introduction

Interspinous (ISD) and interlaminar devices (ILD) are marketed as alternatives to decompression for degenerative lumbar pathologies. The present study aimed to analyze the current literature directly comparing cost and effectiveness of ISDs/ILDs to decompression alone.

Methods

English language studies comparing the cost and outcomes of patients treated with decompression alone or with an ISD/ILD with or without concurrent decompression. Outcomes of interest included postoperative back and leg pain scores, Oswestry Disability Index (ODI), Short-Form 36 (SF36), Zurich Claudication Questionnaire (ZCQ) scores, EuroQoL-5 dimensions (EQ5D) scores, and perioperative complications, total treatment costs. Outcomes were analyzed at: < 6 weeks, 3-months, 6months, 1-year, 2-year, and last follow-up (LFU). Analyses were performed using RevMan software with random effects modeling.

VAS Back F										
ISP/Interlaminar Device		Decompression Alone				Mean Difference	Mean Difference			
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI	
Beyer et al 2013	-0.8	2	6	-2.3	3.4	26	10.9%	1.50 [-0.57, 3.57]		
Brodke et al 2013	-1.8	0	21	-3	0	24		Not estimable		
Kumar et al 2014	-5.247	0.677	22	-2.492	1.184	24	17.1%	-2.75 [-3.31, -2.20]	- -	
Lønne et al 2015b	-3.41	0.86	40	-3.17	0.84	41	17.5%	-0.24 [-0.61, 0.13]	-+	
Meyer et al 2018	-1.83	4.35	72	-1.33	4.4	73	13.7%	-0.50 [-1.92, 0.92]		
Moojen et al 2015	-1.4	5.1	70	-2.4	4.415	75		1.00 [-0.56, 2.56]		
Richter et al 2014	-3.7	1.1	31	-3.7	0.9	31	17.3%	0.00 [-0.50, 0.50]		
Schenck et al 2021	-1.4	7.954	70	-2.4	5.069	75	10.4%	1.00 [-1.19, 3.19]		
Total (95% CI)			332			369	100.0%	-0.18 [-1.27, 0.90]		
Heterogeneity: Tau ^a =	1.72; Chi*	= 77.79. dt	f=6 (P <)	0.00001):	I [#] = 92%					
								-4 -2 0 2 4 Favours ISP/Interlaminar Device Favours Decompression Alone		
									Favours ISP/Intenaminar Device Favours Decompression Alone	
VAS Leg Pa	in - 24	lmon	the							
VAJ LEG FA										
	ISP/Interlaminar Device					Alone		Mean Difference	Mean Difference	
Study or Subgroup	Mean	SD	Total	Mean	\$D	Total		IV, Random, 95% CI	IV, Random, 95% CI	
Beyer et al 2013	0.6	4	6	-4.9	3.3	26	4.4%	5.50 [2.06, 8.94]	,	

Beyer et al 2013	0.6	4	6	-4.9	3.3	26	4.4%	5.50 [2.06, 8.94]		•
Brodke et al 2013	-1.5	0	21	-4.8	0	24		Not estimable		
Gu et al 2018	-7.1	2.6	40	-6.3	2.4	37	15.7%	+0.80 [-1.92, 0.32]	• • •	_
Kumar et al 2014	-5.565	0.902	22	-3.65	1.1839	24	20.0%	-1.92 [-2.52, -1.31]	←	
Lønne et al 2015b	-4.31	0.86	40	-3.32	0.84	41	21.5%	-0.99 [-1.36, -0.62]	I	
Meyer et al 2018	-5.76	3.8	72	-5.38	3.91	73	14.6%	-0.38 [-1.63, 0.87]	• • • •	
Moojen et al 2015	-3.1	4.539	70	-3.2	4.605	75		0.10 [-1.39, 1.59]		
Schenck et al 2021	-3.1	5.212	70	-3.2	5.287	75	11.2%	0.10 [-1.61, 1.81]	•	
Total (95% CI)	341						100.0%	-0.51 [-1.32, 0.30]		_
Heterogeneity: Tau ^a = I	0.75; Chi#=	= 27.16, df:	= 6 (P = 0	.0001); F	= 78%				-1 -0.5 0	0.5 1
Test for overall effect: 2	Z=1.24 (P	= 0.22)							Favours ISP/Interlaminar Device Fav	

A) Any perioperative			-			The Parks	0.11		The state
Study or Subgroup	ISP/Interlaminar D Events	Device Total	Decompression		Weight	Odds Ratio M-H, Random, 95% CI	Odds I M-H. Rando		Risk of Bias
Bever et al 2013	2	12	4	33	5.2%	1.45 [0.23, 9.16]	/		
Brodke et al 2013	ô	21	2	24	2.3%	0.21 [0.01, 4.62]	•		ĂČČČ 🥵
Deyo et al 2013	45	3965	1351	76520		0.64 [0.47, 0.86]	· · · · · · · · · · · · · · · · · · ·		
3u et al 2018	2	40	1331	37	3.4%	1.89 [0.16, 21.81]			
im et al 2007	10	31	2	37	6.1%	6.90 [1.37, 34.85]	·		
ønne et al 2015b	10	40	2	41	3.4%	0.50 [0.04, 5.74]	·		
Acojen et al 2015	4	40	6	41	3.4% 7.8%	0.70 [0.19, 2.58]			
foojen et al 2015 Patil et al 2014	4	174	5 13	174		0.70 [0.19, 2.58]			
°abl et al 2014 Plasencia Arriba et al 2022	6	174	13	174	10.1%		·		
	4					2.24 [0.39, 12.72]			
Postacchini et al 2011		36	3	35	2.4%	0.13 [0.01, 2.56]	·		
Ryu et al 2010	0	16	0	20		Not estimable	/		
Schmidt et al 2018	25	110	26	115		1.01 [0.54, 1.88]			
Strömqvist et al 2013	13	50	3	50	7.7%	5.50 [1.46, 20.76]	,		
Welton et al 2021	10	189	11	378		1.86 [0.78, 4.47]		· · · · · · · · · · · · · · · · · · ·	
Zhong et al 2021	10	46	2	37	6.3%	4.86 [0.99, 23.79]	Ţ	•	
Total (95% CI)		4855		77629	100.0%	1.24 [0.75, 2.05]			
Total events	132		1428				1		
Heterogeneity: Tau ^a = 0.40; Ct		(P = 0.001					0.2 0.5 1	1 1	
Test for overall effect: Z = 0.83			<i>m</i>				0.2 0.5 1 Favours ISP/Interlaminar Device	2 Parameters Son Alone	
B) Reoperation						L		Paroura o compression	<u> </u>
s) Reoperation	ISP/Interlaminar D	Davice	Decompress	The Alone		Odds Ratio	044	s Ratio	Risk of Bia
Study or Subgroup	Events	Total			Weight	t M-H, Random, 95% CI		iom, 95% Cl	
	Events	12		33				T Parts	
Beyer et al 2013									
Brodke et al 2013	10	21		24					
Deyo et al 2013	397	2372		41969					
Galarza et al 2014	4	45		47				·	
Gu et al 2018	2	40		37					
Holinka et al 2011	4	22		28				· · · · · · · · · · · · · · · · · · ·	•••••
Lønne et al 2015a	13	40		41					••••••
Meyer et al 2018	14	72		73					••••••
Moojen et al 2015	23	70		75		5.63 [2.13, 14.87]	1	\rightarrow	
Patil et al 2014	22	174	10	174		2.37 [1.09, 5.17]			· ••••
Plasencia Arriba et al 2022	4	55		59	5.2%	0.44 [0.13, 1.51]		<u> </u>	0000 7
Richter et al 2014	3	31		31				└─── →	
Röder et al 2015	0	50		50					
Schenck et al 2021	23	79		77				·	
Schenck et al 2021 Schmidt et al 2018	23	110		115					2070
Segura-Trepichio et al 2021	14	30		115					
Welton et al 2021	3	189		378					
Zhong et al 2021	7	46	5 4	37	4.8%	1.48 [0.40, 5.50]	•		
Total (95% CI)		3458		43284	100.0%	1.75 [1.23, 2.48]			
Total events				Terre .			*		
	661		2677						
	551	2 - 0.003	3677						
Heterogeneity: Tau ^a = 0.20; CP Test for overall effect: Z = 3.15	Chi ² = 34.70, df = 17 (F	P = 0.00					0.5 0.7	1.5 2	
Heterogeneity: Tau ^a = 0.20; Ct Test for overall effect: Z = 3.15	Chi ² = 34.70, df = 17 (F	(P = 0.00.		- <u></u>			0.5 0.7 Favours ISP/Interlaminar Device	1.5 2 Favours Decompression Alone	
Heterogeneity: Tau ^a = 0.20; CP Test for overall effect: Z = 3.15 C) Wound Infection	Chi ^p = 34.70, df = 17 (F 5 (P = 0.002)		17); I² = 51%				Favours ISP/Interlaminar Device	Favours Decompression Alone	
Heterogeneily: Tau ^a = 0.20; CH Test for overall effect Z = 3.15 C) Wound Infection	Chi ^P = 34.70, df = 17 (F 5 (P = 0.002)	Device	7); I ^a = 51% Decompressio			Odds Ratio	Favours ISP/Interlaminar Device	Favours Decompression Alone Ratio	
Heterogeneity. Tau ^a = 0.20; Ch Test for overall effect. Z = 3.15 C) Wound Infection Study or Subgroup	Chi ^a = 34.70, df = 17 (F 5 (P = 0.002) ISP/Interlaminar Dr Events	Device Total	7); I ^a = 51% Decompressi Events	Total		M-H, Random, 95% CI	Favours ISP/Interlaminar Device Odds I M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	Risk of Bia ABCDEF
Heterogeneily. Tau ² = 0.20; CP Test for overall effect. Z = 3.15 C) Wound Infection Study or Subgroup Brodice et al 2013	Chi ² = 34.70, df = 17 (F 5 (P = 0.002) ISPInterlaminar D Events 0	Device Total 21	7); I ^e = 51% Decompressie Events 1	Total 24	8.6%	M-H, Random, 95% Cl 0.36 [0.01, 9.43]	Favours ISP/Interlaminar Device Odds I M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	
Heterogeneily. Tau ^a = 0.20; Ct Test for overall effect. Z = 3.15 C) Wound Infection Study or Subgroup Brodice et al 2013 Deyo et al 2013	Chi ^a = 34.70, df = 17 (F 5 (P = 0.002) ISPInterlaminar D Events 0 30	Device Total 21 3965	Decompressie Events 1 1343	Total 24 76520	8.6%	M-H, Random, 95% Cl 0.36 [0.01, 9.43] 0.43 [0.30, 0.61]	Favours ISP/Interlaminar Device Odds I M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDEF
Heterogeneik, Tau ² = 0.20; Cf Testfor overall effect. Z = 3.15 C) Wound Infection Study or Subgroup Brokke et al 2013 Deyo et al 2013 Galarza et al 2014	Chi ^a = 34.70, df = 17 (F 5 (P = 0.002) ISPInterlaminar D Events 0 30 0	Device Total 21 3965 45	Decompressie Events 1 1343 0	Total 24 76520 47	8.6%	M-H, Random, 95% Cl 0.36 [0.01, 9.43] 0.43 [0.30, 0.61] Not estimable	Favours ISP/Interlaminar Device Odds I M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDEF
Heterogeneily. Tau ^a = 0.20; Ct Test for overall effect. Z = 3.15 C) Wound Infection Study or Subgroup Brodice et al 2013 Deyo et al 2013	Chi ^a = 34.70, df = 17 (F 5 (P = 0.002) ISPInterlaminar D Events 0 30	Device Total 21 3965	Decompressie Events 1 1343	Total 24 76520	8.6%	M-H, Random, 95% Cl 0.36 [0.01, 9.43] 0.43 [0.30, 0.61]	Favours ISP/Interlaminar Device Odds I M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDEF
Heterogeneik, Tau ² = 0.20; Cf Testfor overall effect. Z = 3.15 C) Wound Infection Study or Subgroup Brokke et al 2013 Deyo et al 2013 Galarza et al 2014	Chi ^a = 34.70, df = 17 (F 5 (P = 0.002) ISPInterlaminar D Events 0 30 0	Device Total 21 3965 45	Decompressie Events 1 1343 0	Total 24 76520 47	8.6%	M-H, Random, 95% Cl 0.36 [0.01, 9.43] 0.43 [0.30, 0.61] Not estimable	Favours ISPilnterlaminar Device Odds M.H., Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDEF
Heterogeneily: Tau?= 0.20; Ct Test for overall effect Z = 3.15 C) Wound Infection Study or Subgroup Brodke et al 2013 Deyo et al 2013 Galarza et al 2018	ChiP = 34.70, df = 17 (F 5 (P = 0.002) ISP.Interlaminar Dr Events 0 30 0 0	Device Total 21 3965 45 40	Decompressie Events 1 1343 0	Total 24 76520 47 37	8.6% 44.2%	M-H, Random, 95% Cl 0.36 [0.01, 9.43] 0.43 [0.30, 0.61] Not estimable Not estimable	Favours ISPilnterlaminar Device Odds M.H., Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDE
Heterogeneiky: Tau? = 0.20; Ct Testforoverall effect Z = 3.15 C) Wound Infection Study or Subgroup Brodke et al 2013 Deyo et al 2013 Oalarza et al 2014 Guetal 2018 Pissencia Arriba et al 2022	Chi ^a = 34.70, df = 17 (f 5 (P = 0.002) ISP.Interlaminar Di Events 0 30 0 2	Device Total 21 3965 45 40 55	Decompressis Events 1 1343 0 0	Total 24 76520 47 37 59	8.6% 44.2% 9.5%	M-H, Random, 95% Cl 0.36 [0.01, 9.43] 0.43 [0.30, 0.61] Not estimable Not estimable 5.56 [0.26, 118.45]	Favours ISPinteriaminar Device Odds M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDEF
Heterogeneik; Tau" = 0.20; Ct Testfor overall effect Z = 3.15 C) Wound Infection Study or Subgroup Brokke et al 2013 Depy et al 2013 Galazza et al 2014 Gu et al 2018 Pissencia Arriba et al 2022 Welton et al 2021 Zhong et al 2021	Chi ^a = 34.70, df = 17 (f 5 (P = 0.002) ISPInterlaminar Di Events 0 30 0 0 2 4	Device Total 21 3965 45 45 40 55 189 46	7); P = 51%	Total 24 76520 47 37 59 378 378 37	8.6% 44.2% 9.5% 27.8% 9.9%	M-H, Random, 95% CI 0.36 [0.01, 9.43] 0.43 [0.30, 0.61] Not estimable Not estimable 5.56 [0.26, 118.45] 1.34 [0.37, 4.81] 6.03 [0.30, 120.63]	Favours ISPinteriaminar Device Odds M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDEF
Heterogeneik; Tau" = 0.20; Ct Testfor overall effect Z = 3.15 C) Wound Infection Study or Subgroup Brokke et al 2013 Deyo et al 2013 Galazza et al 2014 Gu et al 2018 Pissencia Arriba et al 2022 Welton et al 2021	Chi ^a = 34.70, df = 17 (f 5 (P = 0.002) ISPInterlaminar Di Events 0 30 0 0 2 4	Device Total 21 3965 45 40 55 189	7); P = 51%	Total 24 76520 47 37 59 378 378 37	8.6% 44.2% 9.5% 27.8%	M-H, Random, 95% CI 0.36 [0.01, 9.43] 0.43 [0.30, 0.61] Not estimable 5.56 [0.26, 118, 45] 1.34 [0.37, 4.81]	Favours ISPinteriaminar Device Odds M-H, Rando	Favours Decompression Alone Ratio om, 95% Cl	ABCDE

total (solid (solid)) total events 39 1350 leterogeneity: Tau^a = 0.63; Chi^a = 8.09, df = 4 (P = 0.09); i^a = 51% let for operatil offect 7 = 0.09 (P = 0.94)



Results

1699 unique studies were identified, of which 29 met criteria for inclusion in the final analysis. Comparison of patients treated with decompression alone and ILD/ISD suggested the latter had significantly greater improvement in leg pain at 3mo (-1.43; [-1.78, -1.07]; p< 0.001), 6mo (-0.89; [-1.55, -0.24]; p=0.008), and 12mo(-0.97; [-1.25, -0.68]; p< 0.001), but not 2yr (p=0.22) or LFU (p=0.09). Back pain scores were better in the ISD/ILD group only at 1yr (-0.87; [-1.62, -0.13]; p=0.02). SF-36 physical component scores nor ZCQ symptom severity scores differed significantly at any examined endpoint. ZCQ physical function scores showed greater improvement for decompression alone at 6mo (0.35; [0.07, 0.63]; p=0.01) and 12mo (0.23; [0.00, 0.46];p=0.05), while ODI and EQ-5D scores favored ILD/ISD at all time points, with the exception of 6mo ODI scores(p=0.07), though none reached the minimum clinically important difference (MCID). Perioperative complications were nonsignificantly higher in the ISD/ILD group (p=0.41), while reoperations (OR=1.75; [1.23,2.48]; p=0.002) and total care costs (standardized mean difference 1.19; [0.62, 1.77]; p< 0.001) were significantly higher in the ILD/ISD groups.

Conclusion

Patient reported outcomes are largely similar between patients treated with decompression alone and those treated with ILD/ISD for degenerative lumbar pathologies; none of the observed differences reached accepted MCIDs. Costs and rates of reoperation are significantly higher in the ISD/ILD group though, suggesting current evidence does not support ILD/ISD use as a cost-effective alternative to surgical decompression.