Effectiveness of Mechanical Traction for Lumbar Radiculopathy: A Systematic Review and Meta-Analysis

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Outline

- Background
- PICO
- Critical appraisal
- ⊙ CASP 系統性文獻回顧檢核表

Background

- The North American Spine Society recommends conservative treatment as initial management for patients with lumbar radiculopathy.
- Clinicians argue that the existing studies renders uncertain conclusions.
- A subgroup of patients with signs of nerve root compression along with peripheralization of symptoms or positive crossed straight leg raise has been identified as potentially benefitting from intermittent lumbar traction in prone position.







臨床問題

腰部神經壓迫個案需要腰部牽引嗎?

問題/研究族群 Problem/Patient	Lumbar radiculopathy (LR) is a pain syndrome caused by compression/irritation of the lumbar nerve root(s).
給予的措施 Intervention	different types of traction added to or compared with conservative treatments
對照組 Comparison	nontraction therapy: placebo, sham treatment, minimal care, or no intervention
結果 Outcome	Primary outcome:1. Pain; 2. Disability
	 Secondary outcome: 1. mobility; 2. psychological; 3.QOL; 4. neurological function; 5.adherence

Critical appraisal



- Methods
- Results
- Discussion

Methods

- Several keyword combinations
 - Localization: "low back"/"lumbar";
 - Symptoms: "sciatica"/"radiculopathy"/"radicular syndrome"/
 "nerve root pain"/"leg pain/"low back pain";
 - Treatment: "traction"/"physical therapy modalities"
 - Randomized control trial
- Publication date: to April, 30th 2020

Methods

Inclusion criteria

- 1. aged \geq 18 years
- 2. lumbar radiculopathy confirmed by the association of at least 2 of the following 3 diagnostic criteria:
 - 1) complaints of LBP with pain and/or numbness radiating below the knee
 - 2) At least 1 of the following radicular signs (positive clinical examination):
 - a) Sensory loss/paresthesia in any of the L4-S1 dermatomes
 - b) Diminished patellar or Achilles reflex
 - c) Muscle strength deficit in any of the L4-S1 myotomes
 - 3) Lumbar disc herniation demonstrated by MRI or C/T

Exclusion criteria

- 1. only of lumbar pain without signs and symptoms
- 2. other specific diagnoses
- 3. current pregnancy or early postpartum period

Results

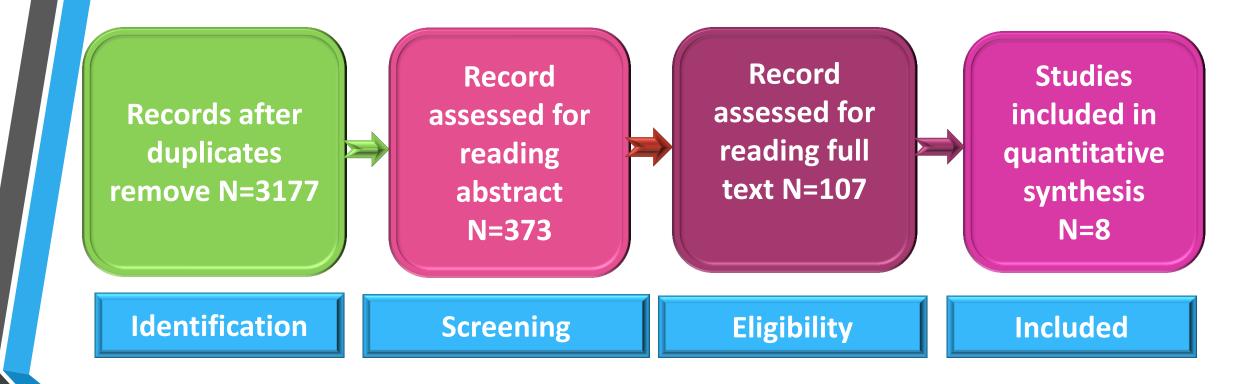


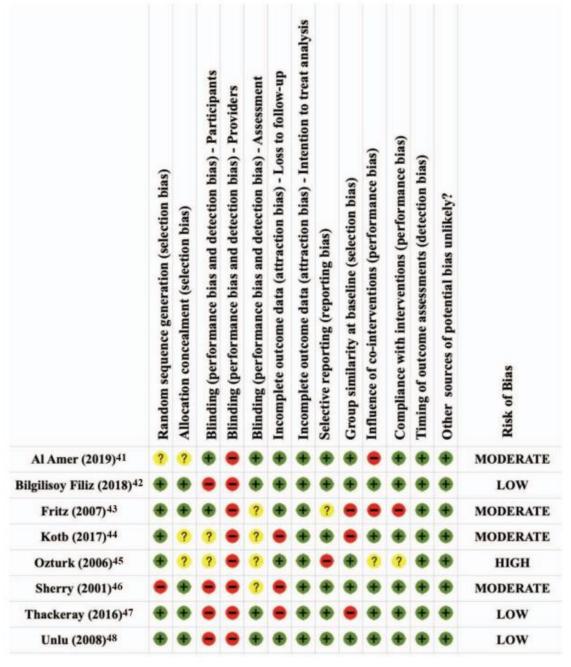
Table 1. Traction Modalities and Parameters of Included Studies^a

Study	Diagnostic Criteria	Sample Size (No. of Patients)	Patient Position	Traction Type	Traction Rhythm	Traction Force	Traction Frequency	Combination With Other Interventions
Al Amer et al ⁴¹ (2019)	Symptoms + physical examination + imaging	60	Supine	Mechanical	Continuous	50% of patient's body weight	20 min, 3 times/wk, for 4 wk	Yes: physical therapy program (local heat/US/exer- cise program)
Bilgilisoy Filiz et al ⁴² (2018)	Symptoms + physical examination	125	Supine/prone	Mechanical	Intermittent	25-50% of patient's body weight, until tolerance	15 min, 5 times/wk, for 3 wk (15 sessions)	Yes: standard physical therapy (US/hot packs/TENS)
Fritz et al ⁴³ (2007)	Symptoms + physical examination	64	Prone	Mechanical	Continuous	40–60% of patient's body weight	12 min/ses- sion, for 12 sessions/wk, for 6 wk	Yes: EOTA
Kotb et al ⁴⁴ (2017)	Symptoms + physical examination + imaging	48	Supine	Mechanical	Intermittent	Decreased over period of 30 s to ~9 kg (20 lb)	Fifteen 2-min cycles, every other day, for 1 mo	Yes: drugs (tri- amcinolone)
Ozturk et al ⁴⁵ (2006)	Symptoms + physical examination + imaging	46	Supine	Mechanical	Continuous	25–50% of patient's body weight	15 min/session, for 5 sessions/wk, for 3 wk	Yes: physical therapy (hot packs/US/dia- dynamic currents)
Sherry et al ⁴⁶ (2001)	Symptoms + imaging	44	Prone	Mechanical	Intermittent	~23–43 kg (50–95 lb)	30 min, for 5 d/wk, for 4 wk; then once/wk, for 4	No
Thackeray et al ⁴⁷ (2016)	Symptoms + physical examination	120	Prone	Mechanical	Continuous	40–60% of patient's body weight	12 min/ses- sion, for 12 sessions/wk, for 6 wk	Yes: EOTA
Unlu et al ⁴⁸ (2008)	Symptoms + physical examination + imaging	60	Supine	Mechanical	Intermittent	35–50% of patient's body weight	15 min/ses- sion, for 5 sessions/wk, for 3 wk	No

 $^{{\}it ^{d}EOTA} = extension \text{-} oriented treatment approach; } TENS = transcutaneous electrical nerve stimulation; } US = ultrasound.$

Adverse Events

Thac	Thackeray et al., 2016 (n:61/120)						
23.0%	stiffness						
44.3%	aggravation of leg/back pain						
26.2%	arm/leg pain						
Less frequent	headache, dizziness, and fatigue						



Cochrane risk of bias Tool

-low risk of bias: 3

-high risk of bias: 1

-moderate risk of bias: 4

Table 2. GRADE Evaluation: Quality of Evidence and Strength of Recommendations^a

			Summary of Findings						
Comparison	Outcome	No. of Studies	Risk of Bias ^b	Inconsistency ^c	Indirectness ^d	Imprecision ^e	No. of Participants	Effect Size, Reported as SMD (95% CI) ^f	GRADE
Prone mechanical traction + physical therapy vs physical therapy	Pain	3: Bilgilisoy Filiz et al ⁴² (2018), Fritz et al ⁴³ (2007), Thackeray et al ⁴⁷ (2016)	Not serious	No inconsistency	No indirectness	No imprecision	263	-0.29 (-0.58 to 0.01)	High
	Disability	3: Bilgilisoy Filiz et al ⁴² (2018), Fritz et al ⁴³ (2007), Thackeray et al ⁴⁷ (2016)	Not serious	No inconsistency	No indirectness	No imprecision	263	-0.10 (-0.34 to 0.14)	High
Prone mechanical traction vs TENS	Pain	1: Sherry et al ⁴⁶ (2001)	Not serious	No inconsistency	No indirectness	-2: imprecision	44	-1.05 (-1.67 to -0.43)	Low
Supine mechanical traction + physical therapy vs physical therapy	Pain	3: Al Amer et al ⁴¹ (2019), Bilgilisoy Filiz et al ⁴² (2018), Ozturk et al ⁴⁵ (2006)	−1: serious	No inconsistency	No indirectness	-1: imprecision	185	-0.58 (-0.87 to -0.29)	Low
	Disability	2: Al Amer et al ⁴¹ (2019), Bilgilisoy Filiz et al ⁴² (2018)	-1: serious	No inconsistency	No indirectness	-1: imprecision	139	-0.78 (-1.45 to -0.11)	Low
Supine mechanical traction vs laser	Pain	1: Unlu et al ⁴⁸ (2008)	Not serious	No inconsistency	No indirectness	-2: imprecision	40	-0.20 (-0.81 to 0.41)	Low
	Disability	1: Unlu et al48 (2008)	Not serious	No inconsistency	No indirectness	-2: imprecision	40	-0.00 (-0.61 to 0.61)	Low
Supine mechanical traction vs ultrasound	Pain	1: Unlu et al ⁴⁸ (2008)	Not serious	No inconsistency	No indirectness	-2: imprecision	40	-0.29 (-0.90 to 0.32)	Low
	Disability	1: Unlu et al ⁴⁸ (2008)	Not serious	No inconsistency	No indirectness	-2: imprecision	40	-0.15 (-0.76 to 0.46)	Low
Supine mechanical traction vs medications	Pain	1: Kotb et al44 (2017)	Not serious	No inconsistency	No indirectness	-2: imprecision	24	-1.42 (-2.30 to -0.55)	Low
	Disability ST	1: Kotb et al ⁴⁴ (2017)	Not serious	No inconsistency	No indirectness	-2: imprecision	24	-1.01 (-1.83 to -0.19)	Low

^aGRADE = Grading of Recommendations Assessment, Development and Evaluation; ST = short term (follow-up at ≤45 d); TENS = transcutaneous electrical nerve stimulation. ^bA quality point was deducted for a trial with an unclear risk of bias and potential limitations that were likely to lower confidence in the estimate effect (methodological rating of quality using the Cochrane Collaboration Risk of Bias Tool = moderate). ^cA quality point was deducted for inconsistency due to conflicting results. ^dA quality point was deducted for indirectness due to clinical heterogeneity. ^eA quality point was deducted for imprecision due to sparse data/data from a single trial. ^fTreatment effects favoring conservative intervention were assigned negative Hedges standardized mean difference (SMD) values.

Comparison	Follow-up	No. of Studies	No. of Partici- pants	Pooled Effect Size, Reported as Hedges g (95% CI)	P	Q for Hetero- geneity	P	I^2	Egger t Test for Publication Bias
1: mechanical traction in prone position + physical therapy vs physical therapy	Pain	3: Bilgilisoy Filiz et al ⁴² (2018), Fritz et al ⁴³ (2007), Thackeray et al ⁴⁷ (2016)	263	-0.29 (-0.58 to 0.01)	.05	2.88	.23	30.44	-0.66
therapy	Disability	3: Bilgilisoy Filiz et al ⁴² (2018), Fritz et al ⁴³ (2007), Thackeray et al ⁴⁷	263	-0.10 (-0.34 to 0.14)	.43	1.46	.48	0	-1.07
2: mechanical traction in prone position vs TENS	Pain	1: Sherry et al ⁴⁶ (2001)	44	-1.05 (-1.67 to -0.43)	.001				
3: mechanical traction in supine position + physical therapy vs physical therapy	Pain	3: Al Amer et al ⁴¹ (2019), Bilgilisoy Filiz et al ⁴² (2018), Ozturk et al ⁴⁵ (2006)	185	-0.58 (-0.87 to -0.29)	.00	1.94	.37	0	-0.57
	Disability	2: Al Amer et al ⁴¹ (2019), Bilgilisoy Filiz et al ⁴² (2018)	139	-0.78 (-1.45 to -0.11)	.02	3.67	.05	72.77	
4: mechanical traction in supine position vs laser therapy	Pain	1: Unlu et al ⁴⁸ (2008)	40	-0.20 (-0.81 to 0.41)	.51				
	Disability	1: Unlu et al ⁴⁸ (2008)	40	-0.00 (-0.61 to 0.61)	1.00				
5: mechanical traction in supine position vs ultrasound therapy	Pain	1: Unlu et al ⁴⁸ (2008)	40	-0.29 (-0.90 to 0.32)	.35				
,p	Disability	1: Unlu et al ⁴⁸ (2008)	40	-0.15 (-0.76 to 0.46)	.63				
6: mechanical traction in supine	Pain	1: Kotb et al ⁴⁴ (2017)	24	-1.42 (-2.30 to	.001				

24

-0.55)

-1.01

(-1.83 to -0.19)

.016

Supine IPT vs. drugs

position vs drugs

Disability 1: Kotb et al44

"TENS = transcutaneous electrical nerve stimulation.

(2017)

Prone IPT vs. TENS

Supine IPT + PT

vs. PT

.62

.48

.66

Prone IPT + PT vs. PT

Result

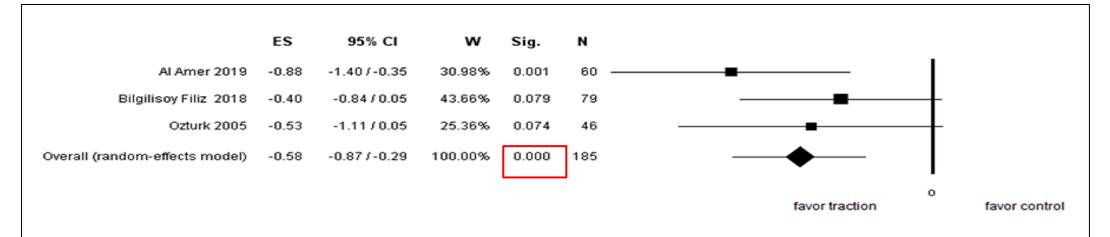
	ES	95% CI	w	Sig.	N			
Bilgilisoy Filiz 2018	-0.59	-1.04/-0.15	30.90%	0.009	79	1 <u>2</u>		I
Fritz 2007	-0.21	-0.70/0.27	27.31%	0.389	64		· -	
Thackeray 2016	-0.11	-0.46 / 0.25	41.79%	0.559	120			
Overall (random-effects model)	-0.29	-0.58 / 0.01	100.00%	0.056	263		-	1
								0
							favor traction	favor contr

A - Comparison between mechanical traction in prone position plus PT versus PT – outcome: pain

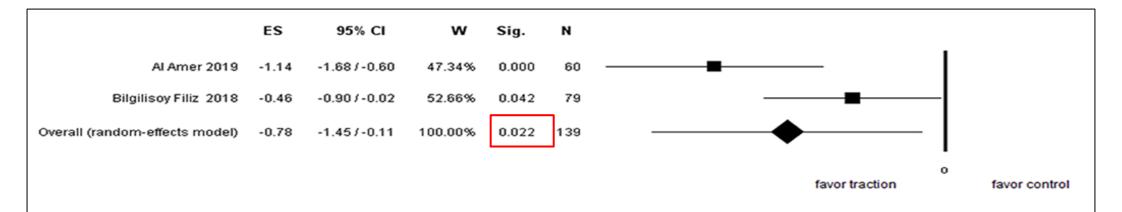
	ES	95% CI	w	Sig.	N	
Bilgilisoy Filiz 2018	-0.30	-0.73/0.14	29.89%	0.188	79	
Fritz 2007	-0.12	-0.61 / 0.36	24.53%	0.618	64	
Thackeray 2016	0.05	-0.30/0.41	45.57%	0.780	120	
Overall (random-effects model)	-0.10	-0.34/0.14	100.00%	0.437	263	-
						favor traction favor control

Spine IPT + PT vs. PT

Result



C - Comparison between mechanical traction in supine position plus PT versus PT – outcome: pain



D - Comparison between mechanical traction in supine position plus PT versus PT – outcome: disability

Discussion

Comparison	Р	Evidence of Quality
Prone IPT+PT vs. PT	Pain & disability : X	high-quality (I ² :30, low bias)
Supine IPT+PT vs. PT	Pain & disability : V	Lower-quality (I ² :72, Moderate bias)
Prone IPT vs. TENS	Pain : V	Lower-quality (single, Moderate bias)
Supine IPT vs. laser	Pain & disability : X	Lower-quality (single)
Supine IPT vs. USD	Pain & disability : X	Lower-quality (single)
Supine IPT vs. drugs	Pain & disability : V	Lower-quality (single, Moderate bias)





Limitation

- The <u>small number of studies</u> included in quantitative synthesis is the most important limitation of this review.
- Only a **small number** of studies were rated as **high quality**, and this may have led to an overestimation of effect.

CASP系統性文獻回顧檢核表



Section A: Are the results of the study valid?

Section B: What are the results?

Section C: Will the results help locally?

1. Did the review addressa clearly focused question?(是否清楚明確問題?)

HINT: An issue can be 'focused' In terms of
☐ the population studied
☐ the intervention given
☐ the outcome considered

Yes	V	
Can't Tell		
No		

問題/研究族群	Lumbar radiculopathy (LR) is a pain syndrome caused by compression/irritation of the lumbar nerve root(s).
給予的措施	different types of traction added to or compared with conservative treatments
對照組	nontraction therapy, sham treatment, minimal care, or no intervention
結果	 Primary outcome: 1. Pain; 2. Disability Secondary outcome: 1. mobility; 2. psychological; 3.QOL; 4. neurological function; 5.adherence

2. Did the authors look for the right type of papers?(尋找合適文獻?)

HINT: 'The best sort of studies' would

- ☐ Address the review's question
- have an appropriate study design (usually RCTs for papers evaluating interventions)

Yes	V
Can't Tell	
No	

 All <u>randomized controlled trials</u> on adults with LR, using mechanical traction, and without any restriction regarding publication time or language were considered.

3. Do you think all the important, relevant studies were included?(重要相關文獻被納入?)

HIN	NT:	Lool	k f	for
				$\mathbf{\circ}$

- Which bibliographic databases were used
- ☐ Follow up from reference lists
- personal contact with experts
- unpublished as well as published studies
- non-English language studies

Records identified through database searching (n=3936):

- PubMed (n=1821)
- CINAHL (n=350)
- PEDro (n=287)
- Cochrane Library (n=297)
- Web Of Science (n=193)
- Scopus (n=988)

Additional records identified through other sources (n=29):

- References from reviews,
 Systematic Reviews, Metaanalysis and Guidelines (n=10);
- Other sources (n=19).

Yes	V
Can't Tell	
No	

We included published RCTs
 without any restriction on publication date, status, or language.

4. Did the review's authors do enough to assess quality of the included studies? (是否評估所納入文獻品質?)

HINT: The authors need to consider the rigour of the studies they have identified. Lack of rigour may affect the studies' results

Yes	V
Can't Tell	
No	

- Two reviewers (A.P., L.T.) independently conducted data extraction and collection using an Excel spreadsheet.
- Cochrane Collaboration Risk of Bias (RoB) Tool.(fig. 2)
- Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.
 (Table 2)

5. If the results of the review have been combined, was it reasonable to do so? (作者將研究結果進行合併是否合理?)

HINT: Consider whether
results were similar from study to study
results of all the included studies are clearly displayed
results of different studies are similar
reasons for any variations in results are discussed

Yes	V
Can't Tell	
No	

- Meta-analysis used a random-effects model.
- ∘ Table 3 and figure 3.

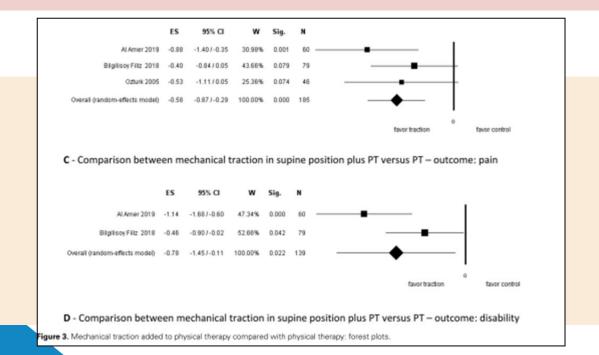
Section B: What are the results?

6. What are the overall results of the review?(文獻整體結果?)

HINT: Consider

- ☐ If you are clear about the review's 'bottom line' results
- what these are (numerically if appropriate)
- how were the results expressed (NNT, odds ratio etc.)

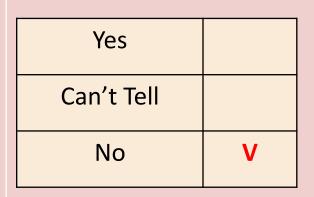
Yes	V
Can't Tell	
No	



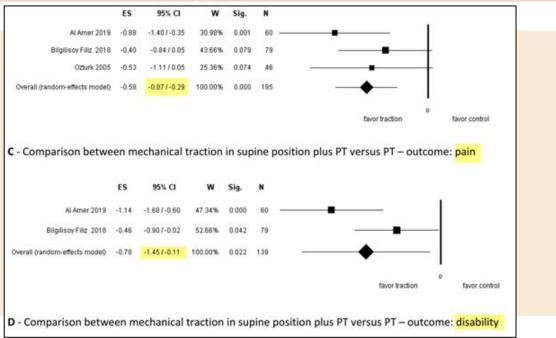
Section B: What are the results?

7. How precise are the results?(結果精準嗎?)

HINT: Look at the confidence intervals, if given



- ∘ Traction + PT vs. PT
- Pain
- ➤ 95%CI: -0.87/ -0.29差異58%
- Disability
- ▶95%CI: -1.45/ -0.11差異134%



Section C: Will the results help locally?

8. Can the results be applied to the local population?(結果是否適合當地族群)

HINT: Consider whether

- the patients covered by the review could be sufficiently different to your population to cause concern
- your local setting is likely to differ much from that of the review

Yes	V
Can't Tell	
No	

 Lumbar radiculopathy (LR) is a pain syndrome caused by compression/irritation of the lumbar nerve root(s).

Section C: Will the results help locally?

9. Were all important outcomes considered?(所有重要臨床結果都有被考慮?)

HINT: Consider whether

☐ there is other information you would like to have seen

Yes	V
Can't Tell	
No	

Pain

Disability

Section C: Will the results help locally?

10. Are the benefits worth the harms and costs?(付出傷害和花費換得介入所產生益處是否值得?)

HINT: Consider

even if this is not addressed by the review, what do you think?

Yes	
Can't Tell	V
No	

Thackeray et al., 2016 (n:61/120)			
23.0%	stiffness		
44.3% aggravation of leg/back pain			
26.2%	arm/leg pain		
Less frequent	headache, dizziness, and fatigue		

排名	疾病	門診就醫人數 (千人)	門診醫療費用(百萬點)	占率 (%)
1	腎衰竭	317	47318	10.33
2	口腔、唾腺和額(顎)骨疾病	11134	40972	8.94
3	急性上呼吸道威染	14537	25756	5.62
4	糖尿病	1454	24905	5.44
5	高血壓性疾病	2502	21235	4.64
6	腦血管疾病	387	8864	1.94
7	食道、胃和十二指腸疾病	3562	8707	1.90
8	消化器官的惡性腫瘤	157	8547	1.87
9	代謝疾患	914	7406	1.62
10	乳房的惡性腫瘤	109	7174	1.57
11	缺血性心臟病	508	6342	1.38
12	其他背部病變	2442	6242	1.36
13	呼吸和胸内器官的惡性腫瘤	52	5870	1.28
14	慢性下呼吸道疾病	1199	5783	1.26
15	脊椎病變	900	5759	1.26
16	影響循環和呼吸系統之症狀和徵候	3193	5685	1.24
17	上呼吸道其他疾病	3255	5501	1.20
18	一般症狀和徵候	3011	5485	1.20
19	炎性多關節病變	759	5392	1.18
20	關節症	1125	5250	1.15

林宜錚, 曹昭懿, & 王劼. (2019). 以價值為基礎的下背痛物理治療. 物理治療, 44(3), 171-179.

表 2. 2011 年全國醫療院所下背痛門診物理治療處方組合分析

治療項目 -	1個	月內	連續 1	個月後	連續2	個月後	連續 3	連續3個月後	
/口/尿/貝口	人數	%	人數	%	人數	%	人數	%	
熱療+電療	3,048	19.2	536	11.1	275	9.4	172	8.8	
熱療+電療+牽引	6,666	42.0	2,344	48.6	1,419	48.5	955	48.9	
運動治療	4,760	30.0	1,492	31.0	950	32.5	637	32.6	
徒手治療	187	1.2	74	1.5	44	1.5	26	1.3	

運動治療:有含運動治療的治療組合;徒手治療:有含徒手治療的治療組合。

資料來源:王劼等人。11

各國下背痛臨床指引物理治療項目建議比較 牽引 徒手治療 運動治療 臨床指引 下背痛診斷 急慢性期 熱療 短波 干擾波 TENS 1. National Collaborat-非特定性下背 急性: Χ Х < 6 wk 未提及 未提及 未提及 ing Center for Primary Care,英國,2009¹² Х Х 亞急性: 6 wk 至 未提及 未提及 未提及 12 m 慢性: X Χ Δ 未提及 未提及 未提及 > 12 m 未提及 未提及 2. Institute of Health 急性: X X X 下背痛 1 Economics,加拿大, 神經痛、神經 < 3 m 證據有限 證據有限 暫時緩解 2011^{13} 根炎等 亞急性: X X X 證據有限 < 3 m 未提及 證據有限 慢性: X 0 X Δ \triangle > 3 m未提及 未提及 輔助治療 證據有限 X X 3. American College 急性(?) 0 X 下背痛疾病 of Occupational and 自行使用 限制次數 Environmental Medi-亞急性 X X X X cine,美國,2011¹⁴ 自行使用 (?) X 慢性(?) X X X 自行使用 合併其他 治療 4. North American Spine 退化性腰椎狹 本指引未 Δ Society,美國, 未提及 未提及 證據有限 證據有限 證據有 窄 分期 未提及 證據有限 201115 限,但可 有限使用

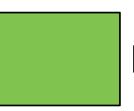
林宜錚, 曹昭懿, & 王劼. (2019). 以價值為基礎的下背痛物理治療. 物理治療, 44(3), 171-179.

表 3. 各國下背痛臨床指引物理治療項目建議比較

公 子图下月用的	前/下1日7117/生	口尽识口发	王成大山中义						
臨床指引	下背痛診斷	急慢性期	熱療	短波	干擾波	TENS	牽引	徒手治療	運動治療
5. American Physical Therapy Association,美國,2012 ¹⁶	下背痛、坐骨神經痛、腰薦椎疼痛、腰椎間盤疾病引發之腰部疼痛、胸椎或腰椎神經根炎等	急性: <1 m	△ 未提及	△ 未提及	△ 未提及	△ 未提及	X	0	0
		亞急性: 2~3 m	△ 未提及	△ 未提及	△ 未提及	△ 未提及	X	0	0
		慢性: >3 m	△ 未提及	△ 未提及	△ 未提及	△ 未提及	X	0	0
6. North American Spine Society,美國, 2014 ¹⁷	腰椎間盤突出 合併神經根炎	本指引未 分期	△ 未提及	△ 未提及	△ 未提及	△ 證據有限	△ 證據有限	0	△ 證據有限
7. Institute for Clinical Systems Improve- ment,美國,2012 ¹⁸	非特定性下背痛	急性: <6wk	○ 暫時緩解	△ 未提及	△ 未提及	△ 未提及	X	0	0
		亞急性: 7~12 wk	○ 暫時緩解	△ 未提及	△ 未提及	△ 未提及	△ 未提及	0	0
		慢性: > 12 wk	自行使用	△未提及	△ 未提及	△ 證據有限 應與運動 結合	△ 證據有 限,應與 運動結合		0
8. Work Loss Data Institute,美國,2013 ¹⁹	與工作相關的 下背痛	本指引未 分期	〇 自行 短暫使用	△ 未提及, 但強調應 著重主動 治療	△ 未提及, 但強調應 著重主動 治療	△ 未提及, 但強調應 著重主動 治療	△ 未提及, 但強調應 著重主動 治療		短暫使用
9. American College of Physicians,美國, 2017 ²⁰	急 性、 亞 急性、慢性下背痛	急性: < 4 wk	\circ	△ 證據有限	△ 證據有限	△ 證據有限	△ 證據有限	X	X
		亞急性: 4~12 wk	△ 未提及	△ 證據有限	△ 證據有限	△ 證據有限	△ 證據有限	X	X
		慢性: > 12 wk	△ 證據有限	△ 證據有限	△ 證據有限	△ 證據有限	X	△ 證據有限	X

腰部神經壓迫個案需要腰部牽引嗎?





同意(綠牌):4位



不同意(紅牌):3位



需要更多文獻支 持(黃牌): 24位