

Efficacy of Postural and Neck Stabilization Exercises on Acute Whiplash-Associated Disorders: A Systematic Review



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Outline

- Background
- Rationale
- Review Question
- Methods
- Results
- Discussion
- Conclusion
- Questions

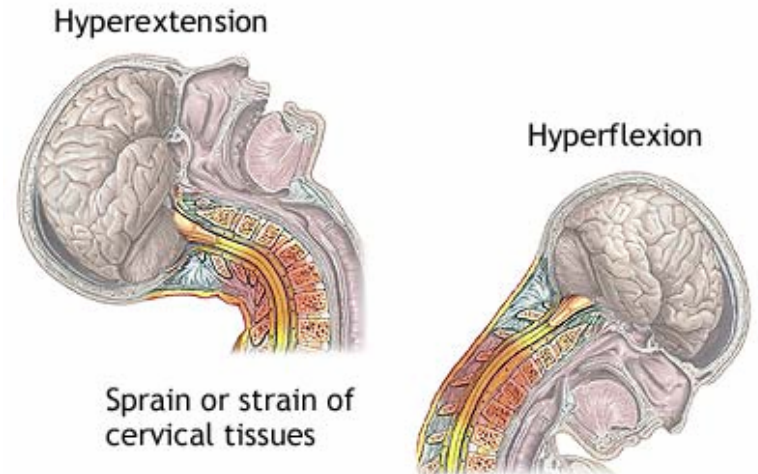


Background



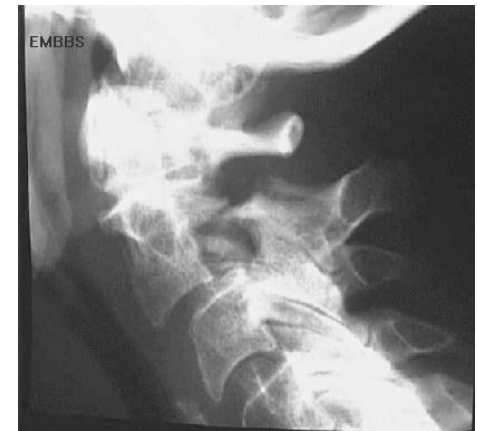
Definition

Whiplash is an acceleration-deceleration mechanism of energy transfer to the neck; it may result from rear-end or side-impact motor vehicle accidents (MVAs), but can also occur during diving or other traumatic events



Quebec Task Force (QTF) Classification of Whiplash-Associated Disorders (WAD) Grades

- Grade 0:
 - No complaints about the neck
 - No physical signs
- Grade 1:
 - Neck complaint of pain, stiffness, or tenderness only
 - No physical signs
- Grade 2:
 - Neck complaint
 - Musculoskeletal signs
- Grade 3:
 - Neck complaint with neurological signs
- Grade 4:
 - Neck complaint
 - Fracture and/or dislocation

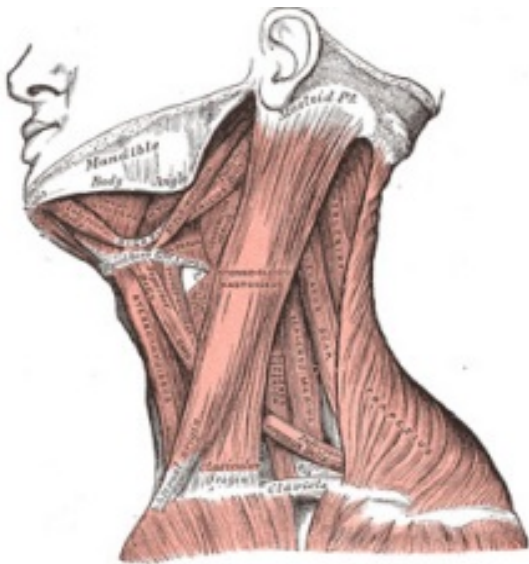


Impact of WAD

- Soft tissue neck and back injuries account for approximately 60% of all bodily injury claims in MVAs
- WAD costs ICBC policyholders more than \$600 million a year
- Chronic WAD cases are responsible for most of the disability costs



Pathophysiology



- Potential damage to ligaments, muscles, nerves and/or boney structures
- Social, psychological and cultural factors influence perception of pain

Symptoms of WAD



- Neck pain
- Neck stiffness
- Headaches
- Shoulder pain
- Arm pain/numbness
- Paraesthesias
- Weakness
- Dysphagia
- Visual disturbances
- Auditory symptoms
- Dizziness
- Cognitive disturbances
- Jaw pain

Possible Treatments for WAD

- Exercise therapy
- Collars
- Prescribed rest
- Manipulation
- Mobilization
- Postural advice
- Traction
- Electrotherapies
- Local heat/ice
- Ultrasound
- Massage
- Surgical intervention
- Steroid injection
- Pharmacology

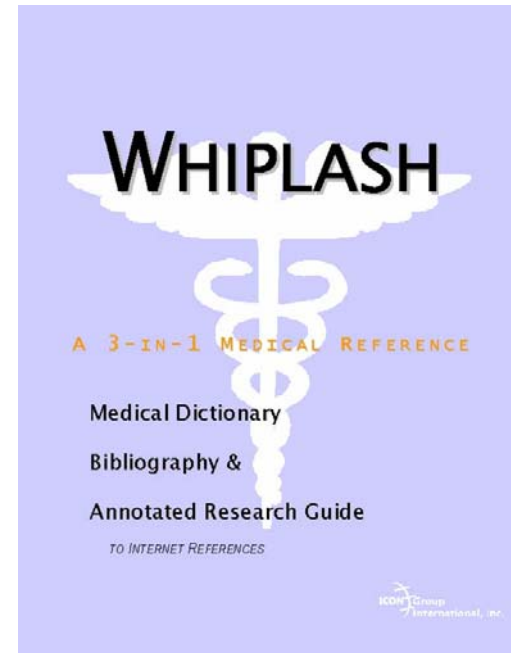
Current Best Practice Guidelines

- The Netherlands:

- Exercise
- Education
- Gradual return to activity

- British Columbia:

- Exercise
- Education
- Manual therapy
- Gradual return to activity and participation



Relevant Cochrane Reviews

Kay et al, 2006: Exercises for mechanical neck disorders; and *Verhagen et al*, 2006: Conservative treatments for whiplash

- Both high quality reviews
- Found that studies of whiplash interventions were often of unacceptable quality, and there was a lack of consistent evidence



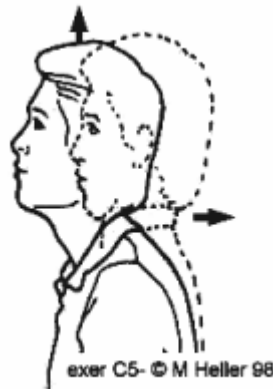
Rationale

- Exercise is a widely used treatment
- Physiotherapy is an intervention that is expensive because it is labour-intensive
- Effectiveness of treatment needs to be evaluated to justify the expense



Review Question

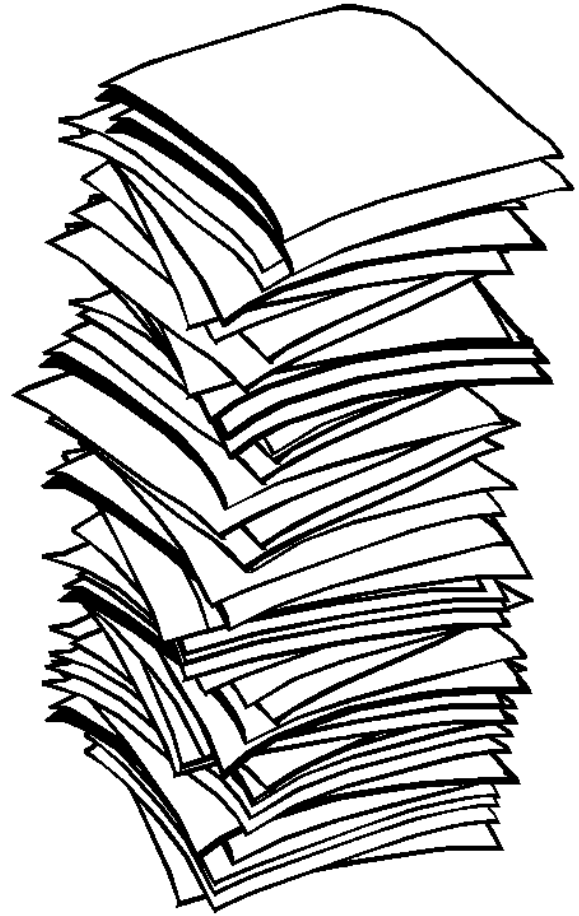
In adults with acute whiplash-associated disorders, do neck stabilization and postural exercises have an effect on pain, range of motion and time off work?



Operational Definitions

- **Neck stabilization** = any exercise that strengthens the muscles surrounding the neck
- **Postural exercises** = any correction, exercise or advice with the aim of improving posture

Methods



Search Strategy

- Electronic database search
- Hand-search of reference lists
- Hand-search of tables of contents
- Contact with experts in the field



Electronic Database Search

- From originating date of database to March 15, 2007
- Limited to humans and English language where possible
 - MEDLINE
 - EMBASE
 - CINAHL
 - PEDro
 - Cochrane Database of Systematic Reviews
 - Cochrane Central Registry of Controlled Trials
 - National Research Registry



MEDLINE Search Strategy

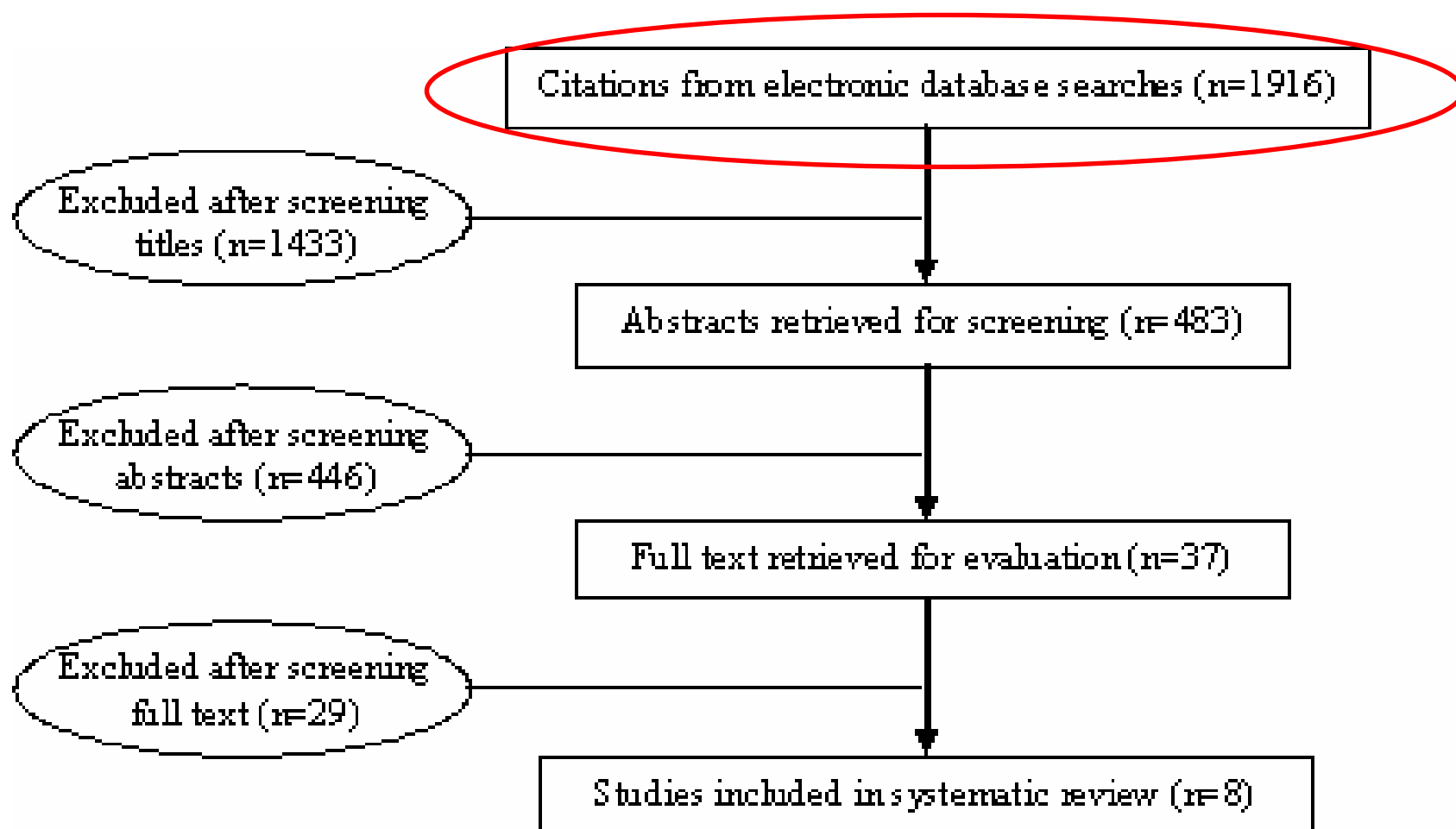
MeSH Terms

1. whiplash injuries
2. neck injuries
3. exp cervical vertebrae
4. sprains and strains
5. neck muscles
6. or/1-5
7. exercise
8. exercise therapy
9. posture
10. or/7-9
11. pain
12. neck pain
13. range of motion
14. articular
15. sick leave
16. absenteeism
17. or/11-16
18. 6 and 10 and 17

Keywords

19. whiplash
20. whiplash associated disorder\$
21. WAD
22. neck injur\$
23. neck hyperextension
24. neck hyperflexion
25. cervical
26. neck sprain
27. neck strain
28. neck muscle\$
29. or/19-28
30. exercise\$
31. postur\$
32. stabili\$
33. or/30-32
34. pain
35. ache
36. neckache
37. cervicalgia
38. cervicodynia
39. range of motion
40. ROM
41. goniomet\$
42. return to work
43. re-entry
44. reentry
45. leave
46. absen\$
47. illness day
48. sick day
49. time loss
50. day loss
51. or/34-50
52. 29 and 33 and 51
53. 18 or 52
54. Limit 53 to (humans and English language)

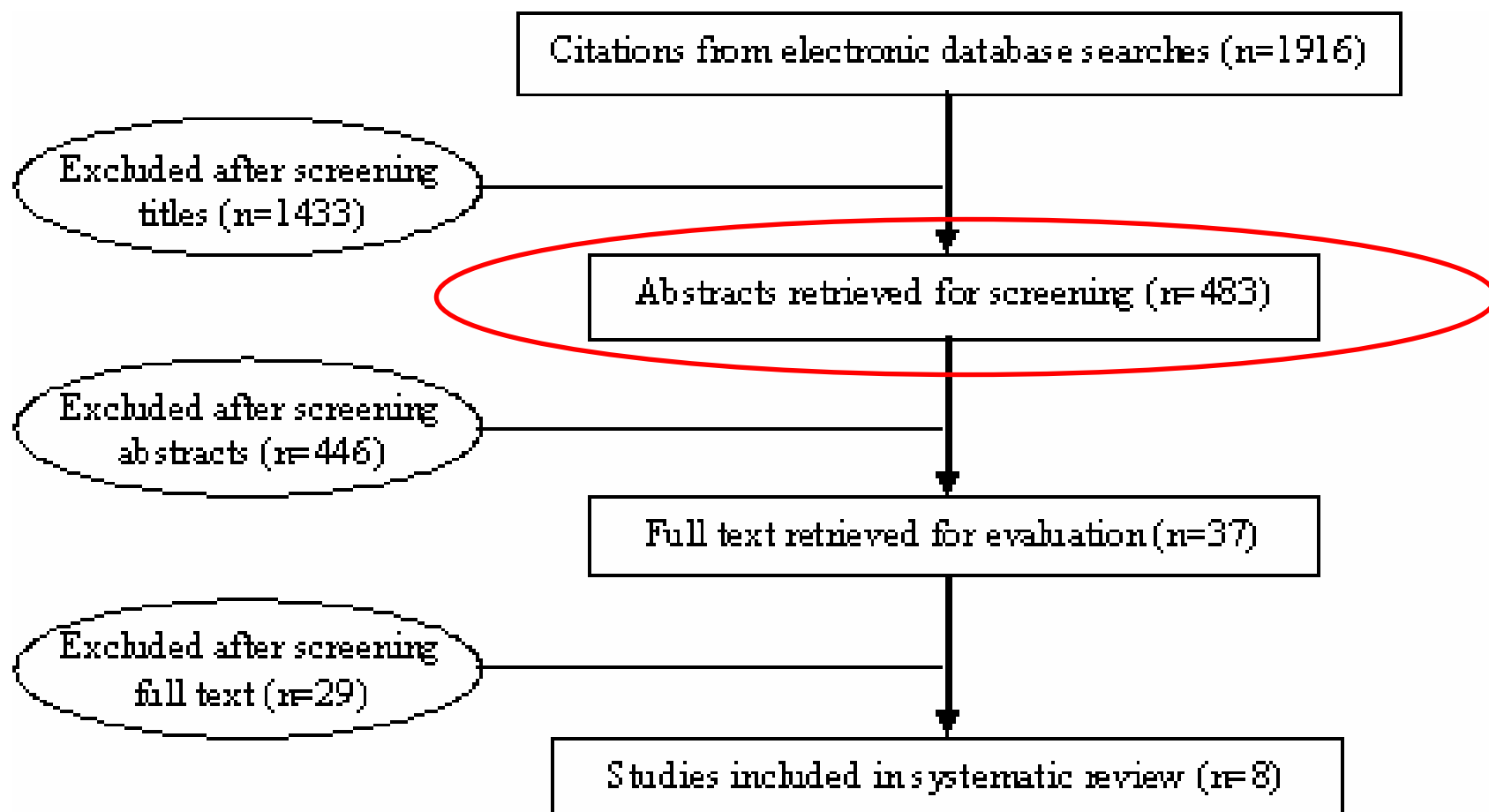
Flow Diagram



Title Screening

- Independently screened for exclusion by two authors
- Exclusion criteria:
 - Published in a language other than English
 - Identified study as a survey or case study
 - Indicated study examined injury to body part other than neck
 - Indicated study population did not include victims of MVAs
 - Indicated study involved children, animals or cadavers
 - Identified specific neck pathologies other than whiplash
 - Indicated study involved a surgical intervention
- Abstracts retrieved for titles selected by one or both reviewers

Flow Diagram



Abstract Screening

- Independently screened for exclusion by two authors
- Exclusion criteria:
 - Included subjects with previous neck injuries
 - Included subjects with WAD grade 4
 - Indicated injuries not sustained in an MVA
 - Involved co-interventions of surgery, traction, electrotherapies, injections, manipulation, or passive mobilizations
- Disagreements resolved through consensus
- Full text retrieved for selected studies

Abstract Screening Form

Reviewer 1:

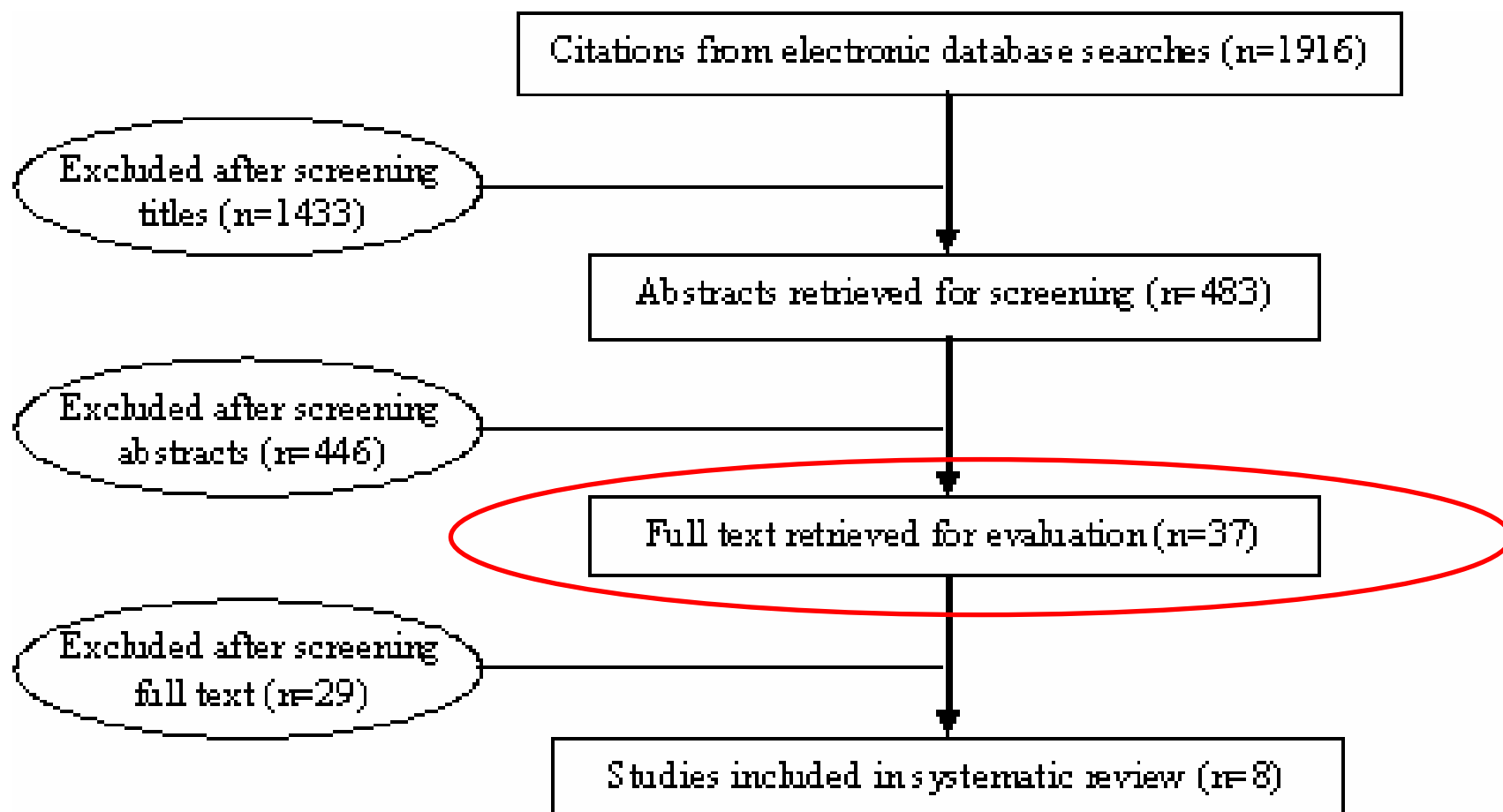
Date of independent review:

Reviewer 2:

Date of consensus:

RefWorks ID	First Author (Last name)	Independent review			Consensus	
		Review full text	Exclude	Reason for exclusion	Review full text	Exclude

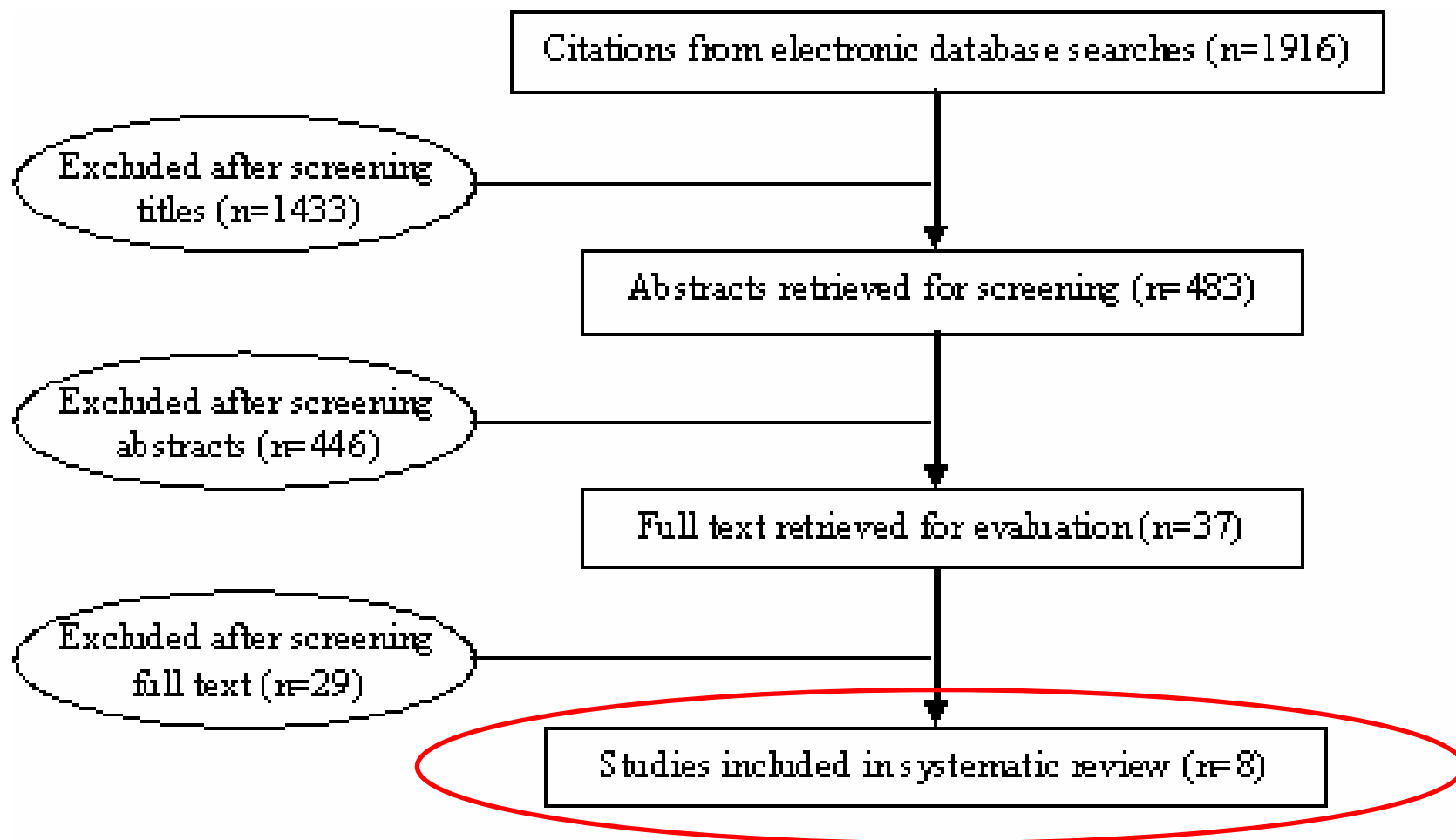
Flow Diagram



Full Text Screening

- Independently screened by two authors
- Inclusion criteria:
 - Randomized or quasi-randomized controlled trial
 - Population consisting of adults (age 18+) with acute (<6 months) grade 1,2 or 3 WAD sustained in an MVA
 - Intervention involving postural and/or neck stabilization exercises
 - At least one of pain, range of motion, or length of time off work as an outcome measure
- Disagreements resolved through consensus

Flow Diagram



Hand-search of Reference Lists

- Two authors independently screened titles of articles in reference lists:
 - Cochrane Review by Kay *et al*, 2006
 - Cochrane Review by Verhagen *et al*, 2006
 - All 8 articles selected for inclusion
- No additional studies found



Hand-search of Tables of Contents

- Two authors independently screened titles of articles in tables of contents from January 2003 to March 2007:
 - *Clinical Orthopaedics and Related Research*
 - *Physical Therapy*
 - *Physiotherapy*
 - *Physiotherapy Canada*
 - *Spine*
- **No additional studies found**



Contact with Experts in the Field

- Contacted seven experts for additional published studies and studies in progress
- Found one relevant study that is in progress in Australia
 - RCT on acute whiplash using exercise for stabilization as part of the management approach
 - 30% of subjects recruited by November 2006
 - Should be considered for inclusion in updates to this review

Assessment of Methodological Quality of Included Studies

- Assessed by two independent reviewers
- Used van Tulder criteria
 - Scored out of 11
 - Recommended for use in the field of back and neck pain by Cochrane Back Review Group

van Tulder Criteria

1. Was the method of randomization adequate?
2. Was the treatment allocation concealed?
3. Were the groups similar at baseline regarding the most important prognostic factors?
4. Was the patient blinded to the intervention?
5. Was the care provider blinded to the intervention?
6. Was the outcome assessor blinded to the intervention?

van Tulder Criteria

7. Were co-interventions avoided or similar?
8. Was the compliance acceptable in all groups?
9. Was the drop-out rate described and acceptable?
10. Was the timing of the outcome assessment in both groups comparable?
11. Did the study include an intention to treat analysis?

Data Extraction

- Performed by two independent reviewers
- Used a modified version of the Cochrane Back Review Group Data Extraction Form



Results



Bunketorp *et al*, 2006



Difference in effect of an individualized supervised physical training program and a self-administered home exercise program on WAD related disability was evaluated

Quality Score: 9/11

Intervention: All



- Neck pain pamphlet
- Ergonomic advice from physiotherapist
- Low-intensity aerobic exercise 20min, twice a week
- Follow-up at 3 and 9 months

Intervention: Control Group



Home exercise program twice a day +
physiotherapy counseling once every 2 weeks for
3 months

- Warm-up of lifting and rolling shoulders
- Shoulder blade adduction
- Passive cervical rotation
- Rowing exercise with an elastic rubber band
- Stretching of the neck muscles

Intervention: Experimental Group



Exercise program supervised by physiotherapist 1-1.5 hours, twice a week for 3 months

- Warm-up on a bike
- Cervical rotation over a wedged pillow
- Strength and endurance training of deep neck flexors (eg cheek to chest in nodding motion)
- Dynamic exercises of neck and shoulders (eg pulls and rows)
- Lifting exercises
- Abdominal and lower extremity exercises

Findings at the three month follow-up



- No statistically significant differences between or within the two groups on:
 - Pain Visual Analogue Scale (VAS)
 - Days off work
 - Cervical range of motion
- Statistically significant improvement of supervised training group over home training group on:
 - Pain Disability Index
 - Analgesic consumption

Crawford *et al*, 2004



Evaluated the effect of early mobilization with an exercise program in the recovery of function following soft tissue neck injuries

Quality Score: 3/11

Intervention



- **All:** Initially supplied with soft cervical collar and non-steroidal anti-inflammatory medication
- **Control Group:** Advised to use collar for 3 weeks then perform self-mobilization exercise regime
- **Experimental Group:** Advised to mobilize freely without collar immediately + self-mobilization exercise regime
- Follow-up at 3, 12 and 52 weeks

Findings



- No statistically significant differences between groups at follow-up on:
 - Pain VAS
 - Total neck range of movement

- Statistically significant differences between groups were found for:
 - Days off work

Rosenfeld *et al*, 2000, 2003, 2006



- Three articles based on one prospective randomized trial
- 2000: evaluated the short-term effect of early active mobilization versus standard treatment after a whiplash injury (six month follow-up)
- 2003: evaluated the longer-term effect (three year follow-up)
- 2006: compared the costs of the active versus the standard intervention

Quality Score: 5/11

Quality Score: 7/11

Quality Score: 7/11



Intervention: Control Groups

- **Early Control Group:** Advised to rest neck and use soft collar for first few weeks after injury then perform active movements 2-3 times daily (Advice provided by leaflet within **96 hours** of MVA)
- **Late Control Group:** Advised to rest neck and use soft collar for first few weeks after injury then perform active movements 2-3 times daily (Advice provided by leaflet **14 days** after MVA)

Intervention: Experimental Groups



- **Early Experimental Group:** Exercises consistent with McKenzie principles once every waking hour beginning within **96 hours** of MVA
- **Late Experimental Group:** Exercises consistent with McKenzie principles once every waking hour beginning **14 days** after MVA

Findings: 2000 (six month follow-up)



- No statistically significant difference in:
 - Days off work
 - Cervical range of motion
- Statistically significant difference in:
 - Pain VAS

Findings: 2003 (three year follow-up)



- Statistically significant difference in:
 - Pain VAS
 - Days off work
- Trend towards improved cervical range of motion compared to the control

Findings: 2006



- Statistically significant difference in:
 - overall cost for active intervention over standard intervention

Schnabel *et al*, 2004 and Vassiliou *et al*, 2006



- Two articles based on one randomized controlled trial
- 2004: Evaluated the effect of soft collar immobilization versus active exercise therapy on WAD (six week follow-up)
- 2006: Evaluated the longer-term effect (six month follow-up)

Quality Score: 6/11

Quality Score: 6/11

Intervention



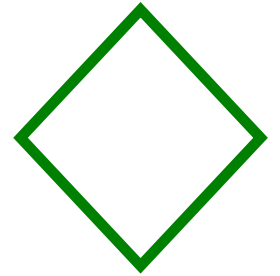
- **All:** 50mg diclofenac three times a day + 50mg ranitidine two times a day
- **Control Group:** Advised to wear soft collar 24 hours a day for one week
- **Experimental Group:** Ten sessions over 14 days with a physiotherapist for instruction in mobilization exercises with an elastic band

Findings: 2004 and 2006



- Statistically significant difference between the groups on:
 - Pain VAS

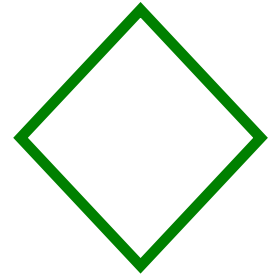
Söderlund *et al*, 2000



Compared the effects of two different home exercise programs on WAD

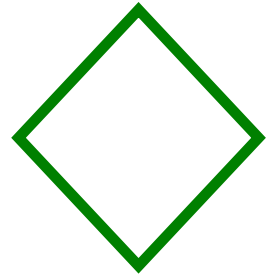
Quality Score: 5/11

Intervention: Control Group



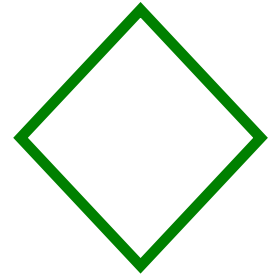
- Advice + exercise program 3 times/day
 - Advice:
 - Alternate rest with activity
 - Keep neck from getting cold
 - Walk a fair distance every day
 - Keep an upright posture while sitting, standing or walking
 - Exercise Program
 - Look over each shoulder 3-5 times
 - Move arms up and down 2-3 times while taking a deep breath
 - Lift shoulders upwards, exhale and relax shoulders

Intervention: Experimental Group



- Same advice + exercise program as control group
- Kinesthetic sensibility and neck muscle coordination exercises three times/day
 - Lie on the ground, imagine a quadrangle under head
 - Gently press each angle of the quadrangle one at a time against the floor, repeat 3 times
 - Press the 2 diagonal angles against the floor at the same time, repeat 3 times

Findings



- No significant difference between groups on:
 - Pain VAS
 - Pain Disability Index
 - Cervical range of motion
- Significant difference within both groups over baseline on:
 - Pain VAS
 - Pain Disability Index
 - Cervical range of motion

Discussion



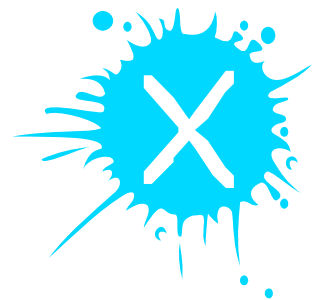
Grading the Evidence According to Sackett



- Grade A: large randomized-controlled trials with clear results
- Grade B: smaller randomized-controlled trials with uncertain results
- Grade C: non-randomized and case control studies

Grading the Evidence According to Sackett

- Grade B evidence to support exercise in the treatment of pain in acute WAD
- Grade B evidence to suggest that exercise can decrease time off work, especially in the long term
- No supporting evidence that exercise will increase ROM



Do Our Results Agree with the Verhagen and Kay Cochrane Reviews?

- No support for collar immobilization over exercise for decreasing pain or promoting early return to work
- Verhagen *et al*, 2006 found conflicting evidence regarding active versus passive treatment with respect to pain and return to work in the first six weeks
- Kay *et al*, 2006 found limited evidence supporting strengthening as a treatment for pain in neck disorders

Common Limitations of Included Studies

- Lack of quality: only one high quality study was included (Bunketorp *et al*, 2006)
- Lack of blinding of both subjects and outcome assessors
- Frequent rate of uncontrolled co-interventions
- High drop-out rates
- Lack of compliance
- Lack of description of the exercises

Limitations of Our Review

- Narrow focus which resulted in exclusion of studies with co-interventions
- Only systematic reviews from the Cochrane Database of Systematic Reviews were evaluated



Practical and Clinical Implications

- Exercise is likely of value in the treatment of WAD



- Collars should be used sparingly in the treatment of WAD

- Although the initial cost of active exercise intervention is high, the overall cost is less when taking into account time off work, reduced productivity and cost of other interventions



Future Questions



- Which specific exercise interventions are most beneficial in the treatment of WAD?
- What is the optimal frequency, intensity and duration for the different exercises?



Conclusion

Although the literature supports the use of active interventions in the treatment of acute whiplash-associated disorders, further research is needed to determine which exercises are most effective and at what frequency, intensity and duration should be prescribed

Acknowledgements

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- Our attentive audience



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Questions?

