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Complex & High Cost Exercise Equipment for Spinal Cord injury

Applying Evidence and Tools to Support Clinical Decisions

Presented by:

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Karakia timatanga

Kia hora te marino

Kia whakapapa pounamu te moana

Hei huarahi mā tatou i te rangi nei

Aroha atu, aroha mai

Tātou i a tatou katoa

Hui e, Tāiki e!

May peace be widespread

May the sea be like greenstone

A pathway for us all this day

Let us show respect for each other

For one another

Bind us all together!

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Objectives

- Build your confidence in prescribing complex exercise equipment.
- Share current literature to support equipment choices.
- Equip you with tools to clinically justify those choices.
- Present a comparison chart to assist in equipment prescription.
- Align clinical practice with national Spinal Cord Injuries (SCI) guidelines and research findings.

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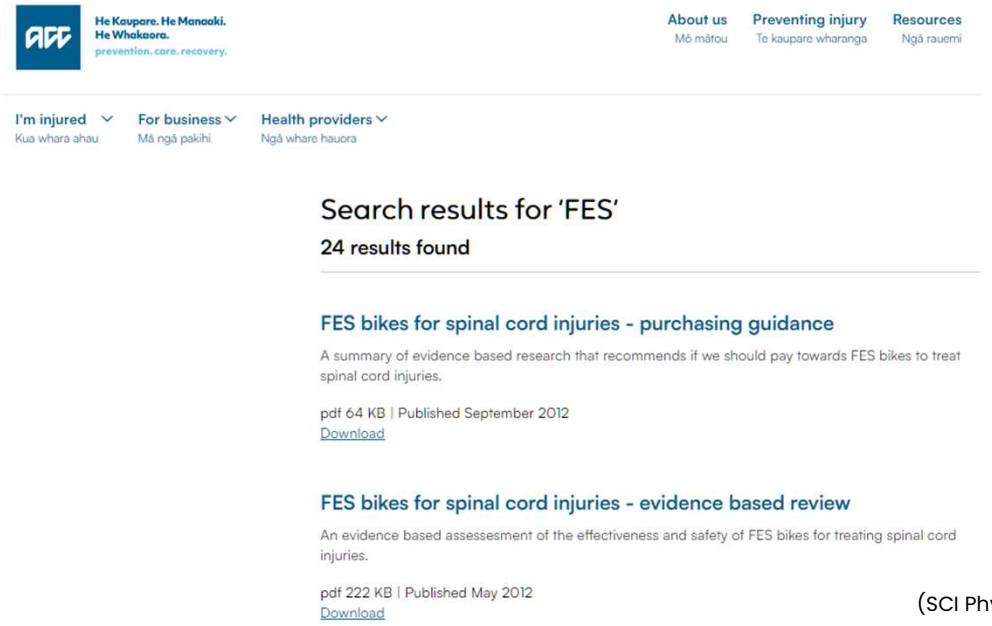
Current resources

SCI Physiotherapy Guidelines
Guiding therapy after spinal cord in

The Australian and New Zealand Physiotherapy Guidelines for people with SCI was funded by icare NSW, National Injury Insurance Scheme Queensland, Transport Accident Commission Victoria, and Lifetime Support Authority South Australia.

The objective of the guidelines

The objective of this guideline is to provide clear guidance on the physiotherapy management of adults with spinal cord injury (SCI) across the continuum of care. It contains evidence recommendations and consensus-based opinion statements for over 100 questions related to the physiotherapy management of people with SCI.



ACC Rapid Review IV

The effectiveness of FES bikes for people with Spinal Cord Injury

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(SCI Physiotherapy Guide, n.d.); (Accident Compensation Corporation [ACC], 2012)

Evidence Review: Methods and Patterns

Search Overview

- Focused on studies published since 2020
- Searched Google Scholar, PubMed, and PEDro
- Keywords: “SCI and exercise,” “FES,” “arm/leg crank/trainer,” “upper and lower limb ergometry”
- Excluded acute SCI studies

Key Study Patterns

- Participants mostly aged 18+ and Caucasian
- Small sample sizes (<25)
- Partial blinding, self-reported activity, and short follow-up
- Covid-19 affected several studies
- Dosing (duration, frequency, intensity), cost-effectiveness, and delivery still unclear

Functional Electrical Stimulation (FES)

Author & Year	Type of research & participants	Intervention	Outcome	Limitations
Rosley et al 2022	Single blind RCT **ASIA C/D** C4 TO T12 for ≥24mths	12 weeks **'FES leg cycling'** versus **'FES leg cycling & FES resisted leg training'**	Adding **FES resisted leg training to FES cycling resulted in some gains in muscle torque and volume** for some muscle groups.	n = 23 (dropouts resulted in low study power).
Farkas et al 2021	Parallel group RCT Untrained **ASIA A/B** T4-10 for ≥12mths	16 weeks **FES leg cycling** versus **arm crank exercise** (ACE).	**ACE group had greater gains** in energy expenditure, peak power point and cardiorespiratory fitness. **Both groups** had decrease in body fat and improved cardiometabolic health.	Multiple (n = 13, no dietary intervention, lack of blinding)
Van der Scheer et al 2021	Systematic review ASIA A-D of various injury levels and various time since injury	Health and fitness outcomes for ≥ 2 weeks **FES cycling.** 92 studies prior to June 2018.	Moderate to high certainty of **increased muscle mass or muscle fatigue resistance.** Low certainty of aerobic fitness and power output.	Low study numbers/power for many studies. Included studies with only 2 weeks FES.

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Compare findings – FES

SCI Physiotherapy Guidelines
sciptguide.com/

Strength training combined with electrical stimulation (v no intervention) on voluntary strength of partially paralysed muscles in people with SCI.

Consensus: Weak For Recommendation

Electrical Stimulation combined with strength training may be provided to improve voluntary strength of partially paralysed muscles in people with SCI.

FES cycling (v no intervention) on atrophy (prevention) in people with SCI and paralysis of the lower limbs

Evidence: Weak For Recommendation

FES cycling may be provided to decrease atrophy in people with SCI and paralysis of the lower limbs.

ACC Rapid Review
acc.co.nz/assets/research/58c56ba17b/fes-review.pdf

FES bikes positively influence cardiovascular health. This is supported by the physiological benefits of any increase in exercise (either passive, active assisted or active) in the presence of extreme inactivity due to widespread paralysis (abridged).

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What we found – Arm crank exercise (ACE)

Author & Year	Type of research & participants	Intervention	Outcome	Limitations
Chiou et al, 2022 (a worthwhile read)	Systematic review **Inactive** ASIA A-D, C4-L3 injury levels and >12 mths post-injury.	**ACE-only** interventions Studies from 1988 – 2021 3 RCTs, 1 non-RCT, 14 pre/post testing (with no control group).	**ACE improves cardiorespiratory fitness.** Authors suggest moderate to vigorous intensity ACE 30-40 mins 3x/week. **Insufficient evidence** to confirm benefits for body composition, cardiometabolic risk, strength, balance or quality of life. No evidence of ACE increasing risk of **shoulder pain**.	Only 4 RCTs. Tendency for high dropout rates impacts the power of the studies. Included studies with as little as 2 weeks intervention.
Sawatzy et al 2022	Crossover trial. Exercising ≥1x/week. ASIA A/B lower cervical to lumber injury level for ≥2 years post- injury.	5 mins **Adapted rower (AROW)** **Versus** 5 min **ACE**, at self-selected low & moderate intensity.	**AROW had greater rate of perceived exertion and oxygen consumption** at a given workload. Of note, a companion qualitative research indicated participants felt they had a **better work out** on AROW.	n=14. Exercise were **one-off sessions and only for 5 mins.** Not randomized.

"Weak evidence-based recommendation: ACE **may** be provided to improve fitness in people with SCI"' - *SCI Physiotherapy Guideline*

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What we found – Home exercise

Author & Year	Type of research & participants	Intervention	Outcome	Limitations
Celebi et al 2025	Exploratory mixed method (semi-structured interview and usability survey). Tetraplegia and paraplegia. Ready to participate in exercise.	Using **home** rowing machine **vs gym** rowing machine – 1 month each.	• Rated home as more useable. • Home – easy to **access**, **motivated** to use, greater **independence** & rower adapted to individual. • Gym – **social & motivating environment**, better quality equipment and **access to other equipment**. • Both – adequate exercise intensity achieved & easier to get more cardio. • Barriers – **cost**, lack of **space for home** equipment, **accessing the gym** and the grip/handle (if hand function is impacted).	n = 4 so **data saturation not achieved** (Covid and several willing participants didn't have enough space in their homes). They all started with home exercise due to Covid.

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What we found – Home exercise

Author & Year	Type of research & participants	Intervention	Outcome	Limitations
Froehlich-Grobe et al 2022 (worth a read)	Parallel group RCT Not currently achieving 150 mins physical activity/week. Tetraplegia & paraplegia (ASIA grades not indicated).	Workout on Wheels (WOW) programme – 16 weekly online modules, resources and **virtual group sessions** (vs waitlist). Used **activity monitor** & heart rate strap (WOW group only). Included variety of exercise (aerobic, strength training etc). Basic equipment included tabletop pedal exerciser.	• 120/168 completed 16 weeks. **75% finished** the program. • WOW - greater time spent in vigorous activity, and **improved feeling of having control over changes (towards goals).** • Most reached goal of 150min/week aerobic exercise by week 9, which was maintained until week 24. • Small gains in VO2 peak and peak power. • Reported **fewer exercise barriers**, and greater self-efficacy for exercise and **nutrition**. • **Remained more active** 2 months after program.	Difficulty accessing Polar monitor data. No objective exercise monitoring of control group. Subjective activity questionnaire not validated.

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What this means for you

Domain	SCI guidelines / ACC FES review	2021 – 25 evidence	Takeaway
Arm-crank exercise for fitness	Weak evidence-based recommendation: ACE may be provided to improve fitness in people with SCI	New studies confirm ↑ VO_2peak 6-22 %	Still weak, but confidence growing
Remote delivery & feasibility – refer to home	Mainly clinic-based evidence	WOWii, tele-HIIT show 60-75 % adherence	Home programs feasible Consider the individual, what works for them and will help motivate them
FES cycling to limit atrophy	Weak evidence-based recommendation: FES cycling may prevent atrophy	RCT + review show ↑ muscle size, esp. with PRT	Support strengthened
FES cycling to support fitness	FES cycling may influence cardiovascular health, especially when extreme inactivity is present.	N/A	Potential role in addressing inactivity-related health risks.

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Choosing the Right Equipment

Match equipment to client goals, ability, and environment.

Use templates and examples on our website.

Compare options with the comparison chart.

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Case example

Goals	Problem list	Equipment	Considerations
To hand cycle 3 times per week To increase UL and LL strength To improve cardiovascular fitness	Doesn't have access to an upper limb and lower limb ergometer	Supapedal THERA-Trainer MOBI Motomed loop light.la Motomed loop.la Rehamoto Stairmaster UBE	Tetra hand-friendly Would benefit from upper and lower limb exercise

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Feedback

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These presentations are to support your learning and development.

We want to hear what areas you would like to explore.

We welcome any comments or feedback about today's session.

Click here to answer

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Key takeaways

- Current evidence supports FES, arm cranking, and home exercise.
- Despite research limitations, recent studies show consistent benefits.
- Use of tools and charts to strengthen your clinical justification.
- Comparison charts help match equipment to client needs.
- Align recommendations with national SCI guidelines and best practice.

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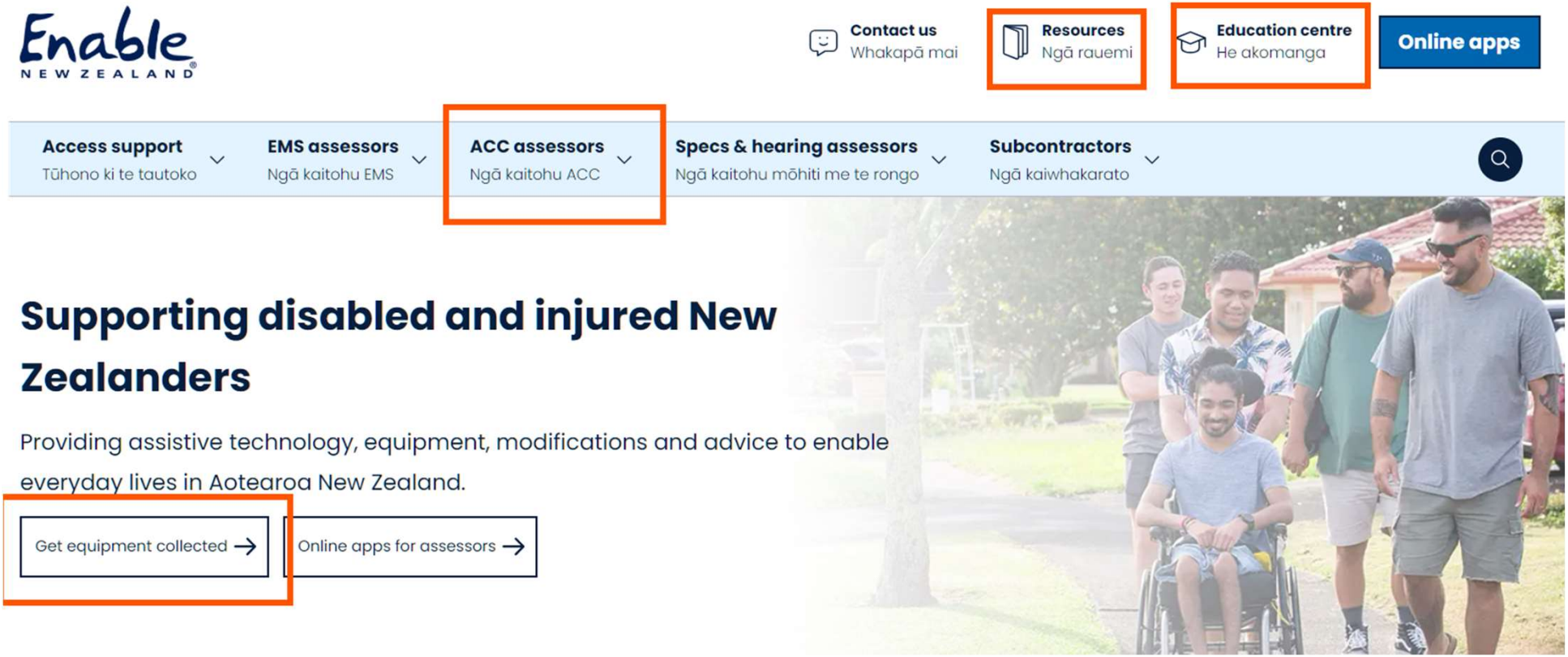
Website: enable.co.nz



Questions /Contact us

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Closing Karakia

Kia whakairia te tapu

Kia wātea ai te ara

Kia turuki whakataha ai

Kia turuki whakataha ai

Haumi e, Hui e, Tāiki e!

Restrictions are moved aside

So the pathways are clear

To return to everyday activities

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