Evidence check

Post amputation care

30 July 2026

Evidence check question

1. What guidelines are available on post-amputation care?
2. What is the evidence for rigid removable dressings compared to other dressings after amputation?
3. What are best-practice management strategies for post-operative and lifelong pain following amputation?

Summary

Question 1: Post-amputation care guidelines

- Seven guidelines and consensus statements were identified from the United States,[1, 2] the United Kingdom,[3, 4] the Netherlands[5] and international groups.[6, 7]
- The guidelines and consensus statements vary in scope, amputation level, phase of care covered and methodological rigour.[1-7]
- There is consistency in principles of good care across the guidelines and consensus statements:
  - All documents emphasise coordinated multidisciplinary care, early and structured rehabilitation, psychological support, and strategies for limb preparation and pain management.[1-7]
- Nearly all recommendations are rated as weak, with low or insufficient evidence underpinning them.[1, 2, 4-8]

Question 2: Evidence on rigid removable dressings

- The evidence on rigid removable dressings was synthesised from 13 articles. The research base included a mix of systematic, integrative and narrative reviews, and randomised trials and cohort studies.
- Overall, the studies found:
  - removable rigid dressings are effective for early swelling reduction,[9-11] faster limb maturation (shrinks, heals, and stabilises in shape and volume),[9] reduced need for revision surgery,[12, 13] and shorter hospital stay[9, 11, 14]
  - the benefits of removable rigid dressings on pain,[10] and long-term functional outcomes[11] are emerging, with limited studies reporting on these outcomes
  - effects of removable rigid dressings on wound healing,[6, 9, 11, 15] are uncertain, with some studies reporting faster wound healing, while others reported no difference compared to soft and rigid dressings

  - effects of removable rigid dressings on time to prosthetic casting and fitting,[9, 11] are uncertain, with some studies reporting faster time to casting and fitting compared to soft dressings and others reporting no difference compared to rigid dressings.
- Variation in patient characteristics, surgical techniques, dressing protocols and outcome measures contribute to the uncertainty of the evidence.

Question 3: Best-practice pain management of postoperative and lifelong pain

- The evidence on pain management strategies was synthesised from 35 review articles. Evidence for pain management varies substantially by pain type.
- Most of the evidence on pain management strategies exists for phantom limb pain (PLP) compared with postoperative pain or residual limb pain (RLP).
  - Multimodal pharmacology (morphine, NSAIDs, paracetamol, clonidine, ketorolac, possibly calcitonin) supports early postoperative pain control.[16-19]
  - Morphine reduces RLP and PLP.[17, 19-22]
  - Rehabilitation and behavioural therapies such as mirror therapy, virtual reality and augmented reality motor therapies, graded motor imagery, particularly when combined with each other have consistent evidence for reducing PLP.[20, 23-29]
  - Surgical techniques such as targeted muscle reinnervation, regenerative peripheral nerve interface, nerve coaptation and wrapping, and peripheral nerve stimulation reduce RLP,[30-32] and PLP.[17, 23, 30-32]
  - Continuous peripheral nerve block,[16-18, 33, 34] single-shot peripheral nerve blocks[16, 18] and spinal[16] or epidural[17, 33] anaesthesia reduces immediate postoperative pain and opioid use.
  - Transcutaneous electrical nerve stimulation can improve RLP.[24]
  - Neuromodulation techniques, such as neuromuscular electrical stimulation,[35] dorsal root ganglion stimulation,[36] motor cortex stimulation,[36] and deep brain stimulation[35, 36]can improve PLP.
- The evidence base is characterised by heterogeneous trials with small sample sizes; inconsistent outcome tools used; and overlap of primary studies included in the reviews.

Evidence

What guidelines are available on post-amputation care?

Five guidelines[1-5] and 2 consensus statements[6, 7] related to amputations of major extremities in adults were identified in the peer-reviewed and grey literature and reviewed for this evidence check.

The guidelines and consensus statements vary in their setting, amputation level and focus:

The **2024 United States Department of Veterans Affairs and Department of Defense (VA/DOD) lower limb amputation guideline** provides VA/DOD clinicians and community providers an evidence-based framework for evaluating and managing care of adult patients, 18 years or older, who have experienced lower limb amputation (LLA) in VA/DOD systems. This guideline emphasises patient-centred care, the need for a multidisciplinary team, and lifelong management.[1]

The **2022 United States VA/DOD upper limb amputation guideline** provides physicians, therapists, prosthetists and rehabilitation teams with an evidence-based framework for the care and rehabilitation for adult patients, 18 years or older, who have experienced upper limb amputation (ULA). This guideline emphasises a flexible recovery process, lifelong care, and psychosocial screening.[2]

The **2022 National Institute for Health and Care Excellence Guideline: Rehabilitation after traumatic injury** provides a section specific to rehabilitation for people (adult, children and young people) after limb reconstruction, limb loss or amputation. This section of the guideline emphasises rehabilitation, multidisciplinary care, and psychological support.[3]

The **2020 Dutch lower limb amputation and prosthetics guideline** provides current standards for the best care for adult patients (18 years or older) with a LLA due to vascular disease, a tumour, or trauma. This guideline emphasises surgical level decisions, structured rehabilitation, and validated outcome measures.[5]

The **2017 United Kingdom pre and postoperative physiotherapy guideline** is an evidence-based framework for the preoperative and postoperative physiotherapy management of adults with LLAs. This guideline emphasises the physiotherapist's role in care, early mobility and compression therapy.[4]

The international **enhanced recovery after surgery (ERAS) consensus statement for perioperative care of major lower limb amputation** provides evidence-based suggestions for coordinated perioperative care for adult patients undergoing major LLA due to non-reconstructable chronic limb-threatening ischemia. This consensus statement emphasises the ERAS principles, perioperative optimisation and coordinated transitions.[6]

The international **delphi consensus on treatment for phantom limb pain** provides recommendations for the management of PLP in amputees. This consensus statement emphasises nonpharmacological interventions.[7]

- Most of the guidelines and consensus statements are for LLA,[1, 4-6] with only one specifically for ULA[2] and 2 not specifying amputation level.[3, 7]
- All guidelines advocate for a multidisciplinary approach to care, emphasising coordinated care involving surgeons, physiotherapists, prosthetists, psychologists and nurses.[1-6]
- Overall, guidelines and consensus statements recommended:
  - Pain management including analgesia following surgery and visualisation methods such as mirror therapy for PLP.[1-3, 5, 7]
  - Use of elevation and compression (e.g. rigid dressing) for residual limb care, specifically for oedema and shaping.[1, 3-6]
  - Phased rehabilitation (preoperative, postoperative and long-term rehabilitation phases) focusing on optimising residual limb healing, early mobilisation and prosthetic training.[1-5]
  - Individualised care, tailoring rehabilitation plans to patient-specific factors (age, comorbidities, functional goals).[1, 2, 4, 5]
  - Psychological support before amputation and after amputation to address trauma, distress, and body image concerns.[1-7]
- Each guideline[1, 2, 4, 5, 8] and one consensus statement[6] are based on systematic literature reviews and the quality of evidence assessed using the GRADE methodology. Most recommendations in the guidelines and consensus statement note low or insufficient evidence.

What is the evidence for rigid removable dressings compared to other dressings after amputation?

Rigid removable dressings (RRD) show potential benefits for early limb management (swelling, maturation), revision surgery and length of hospital stay. Effects on wound healing, infection, pain and broader outcomes remain uncertain.

RRDs and non-RRDs are the 2 main types of rigid dressings used after amputation. RRDs are a synthetic or plaster cast that allow flex. It is easily removed from the residual limb for less than 10-minute periods at a time, to allow for frequent wound inspection. Non-RRDs are a sealed plaster cast dressing that immobilises the residual limb in extension for approximately 3 days.[37]

- Clinical outcomes
  - Wound healing
    - Mixed evidence for rigid dressings, including RRD and the proportion of wounds healed or complications, and time to wound healing.[6, 9-11, 14, 15, 38-40] Some research reports that RRD and rigid dressings improve wound outcomes compared with soft dressings.[6, 9, 14, 39, 40] Some research reports that RRD and rigid dressings provide no benefit compared with soft dressings for wound outocmes.[6, 10, 15]
    - Infection rates are similar between rigid and soft dressings.[10, 14, 15]
    - Negative pressure wound therapy (while not a rigid dressing) reduces infection risk and wound complications compared with standard care.[41]
  - Swelling and limb maturation (shrinks, heals, stabilises in shape and volume)
    - RRD reduces stump swelling and speeds residual limb maturation in the short term compared with soft dressings.[9-11]
    - Evidence for rigid dressings overall is mixed.[38-40] Some research reports less stump swelling with rigid dressing,[40] while other research reports no difference in swelling between rigid and soft dressings.[39]
  - RRD reduces the rate of revision surgery.[12, 13]
    - Evidence for rigid dressings overall is mixed.[9, 10, 14, 38, 39] Some research reports reductions in revision surgery rates,[9, 39] while other research reports no difference compared with soft dressings.[10, 14]
  - RRD may lead to faster pain reduction.[10]
    - Evidence for rigid dressings overall effect on pain is mixed.[9, 38, 39] Some research reports no difference between rigid and soft dressing for time to no pain,[9] while other research reports that patients with rigid dressings experience less pain compared to patients with soft dressings.[39]
- Functional outcomes
  - Rigid dressings, including RRD reduce joint contracture compared to soft dressings.[9, 14, 39, 40]
  - RRD appear to benefit physical function outcomes.[11, 12]
    - Evidence for rigid dressing overall is mixed.[9, 14, 38] Some research reports benefits for function outcomes compared to soft dressings,[14] while other research reports no difference between rigid and soft dressings on functional outcomes.[9]
- Psychosocial
  - Patients report feeling safer and more confident with RRD.[10]
  - Patient satisfaction is positive for rigid dressings overall,[40] but emotional well-being remains poor post-amputation.[42]
- Health service outcomes
  - RRD may shorten hospital stay compared with soft dressings and non-RRD.[9, 11, 14]

  - Evidence for rigid dressings overall is mixed.[6, 38, 39] Some research reports rigid dressing may shorted hospital stay compared with soft dressing,[39] while other research reports no difference in hospital stay between rigid and soft dressing.[6]
- Evidence for RRD and rigid dressings overall and time to prosthetic casting and fitting is mixed.[6, 9-11, 15, 38-40]
  - Some research reports that RRD reduces time to prosthetic casting and fitting compared to non-RRD and soft dressings.[9, 11] Other research reports no difference in time to casting and fitting between RRD and rigid or soft dressings.[9]
  - Some research reports that rigid dressings reduce the time to prosthetic casting and fitting compared to soft dressings.[10, 11, 39, 40] Other research report no differences in time to casting between rigid and other dressings.[15]
- No cost-effectiveness studies identified for RRDs.[9]

Limitations of the evidence base for dressings after amputation:

- Heterogeneity of studies
  - Populations vary widely (e.g. level of amputation, comorbidities), making it difficult to generalise findings.[10, 11, 13, 38-42]
  - Dressing protocols differ across studies (materials, timing, clinician expertise), introducing variability in outcomes,[12, 15, 39-41] or were poorly described[6, 10, 38] limiting pooling in reviews and confounding dressing specific effects.
- Inconsistent outcome measurement
  - Definitions of outcomes such as wound healing, complications and functional recovery are not standardised, limiting synthesis and comparability.[6, 11, 12, 14, 15, 38-41]
  - Outcomes (e.g. swelling reduction, prosthetic readiness), measurement tools and time points varied across studies.[6, 10, 12, 13, 15, 38-40, 42]
- Limited high-quality evidence
  - Many conclusions rely on small underpowered primary studies which are prone to bias.[11-15, 38, 40-42]
  - Systematic reviews often report uncertainty or conflicting results due to low certainty of evidence.[6, 10, 15, 38, 39, 41]
- Gaps in the evidence
  - No studies comparing RRD with alternative dressing for upper extremity amputations were identified.
  - No cost-effectiveness studies comparing RRD with alternative dressings were identified.

What are best-practice management strategies for post-operative and lifelong pain following amputation?

Pain management strategies are generally described in the context of postoperative pain, PLP and RLP. Much of the evidence for amputation pain management is on PLP.

- Pharmacological
  - Multimodal pharmacology (morphine, NSAIDs, paracetamol, clonidine, ketorolac, possibly calcitonin) supports early postoperative pain control.[16-19]

    - Evidence for the effect of ketamine and gabapentin on postoperative pain is mixed. Some studies suggest they may be effective in reducing postoperative pain[18] while others found no effect.[18, 33]
  - Morphine and lidocaine reduce RLP.[19]
    - Evidence for the effect of botulinum toxin are mixed. Some studies suggest it may be effective in reducing RLP, while others found no effect.[43]
  - Morphine reduces PLP.[17, 19-22]
    - Evidence for the effect of memantine, ketamine, gabapentin and botulinum toxin are mixed. Some studies suggest they may be effective in reducing PLP,[16, 17, 19, 21, 43] while others found no effect.[16-22, 43]
- Rehabilitation, physical and psychological therapies
  - Rehabilitation and behavioural therapies such as mirror therapy and virtual reality and augmented reality do not reduce RLP.[23, 24]
  - Rehabilitation and behavioural therapies such as mirror therapy, virtual reality and augmented reality motor therapies, graded motor imagery, particularly when combined with each other have strong consistent evidence for reducing PLP.[20, 23-29]
- Surgical
  - Surgical techniques such as targeted muscle reinnervation (TMR), regenerative peripheral nerve interface (RPNI), nerve coaptation and wrapping, and peripheral nerve stimulation (PNS) reduce RLP.[30-32]
  - Surgical techniques such as TMR, RPNI, nerve coaptation and wrapping, and PNS reduce PLP.[17, 23, 30-32]
    - Surgical techniques such as targeted nerve implantation, traction neurectomy, and coblation show promise for preventing or reducing PLP.[17]
- Peripheral nerve blocks and regional anaesthesia
  - Continuous peripheral nerve block (CPNB),[16-18, 33, 34] single-shot peripheral nerve blocks[16, 18] and spinal[16] or epidural[17, 33] anaesthesia reduce immediate postoperative pain and opioid use.
  - There is mixed evidence for nerve blocks and regional anaesthesia as management strategy for PLP.
    - Some studies found that CPNB reduced PLP,[16, 17, 22] while others found no effect.[17, 34]
    - Some studies found cryoneurolysis reduced PLP,[23, 44] while others found no effect.[22, 23]
    - Some studies found epidural analgesia reduced PLP,[16, 17, 45] while others found no effect.[17, 18]
- Neuromodulation
  - Transcutaneous electrical nerve stimulation (TENS) can reduce RLP.[24]
  - Evidence to support transcranial direct current stimulation (tDCS) as a management strategy for RLP is mixed.[23] Some studies found a benefit, while others did not.
  - Neuromodulation techniques, such as neuromuscular electrical stimulation,[35] dorsal root ganglion stimulation,[36] motor cortex stimulation,[36] and deep brain stimulation[35, 36] improve PLP.
  - Evidence to support repetitive transcranial magnetic stimulation (rTMS) as a management strategy for PLP is mixed. Some studies found that rTMS reduced PLP,[21-24, 29, 36, 46] while others found no effect.[23, 35, 46]

- Evidence to support tDCS as a management strategy for PLP is mixed. Some studies found that tDCS reduced PLP,[22-24, 35, 36, 46-48] while others found no effect.[23, 46]
- Evidence to support repetitive TENS as a management strategy for PLP is mixed. Some studies found that TENS reduced PLP,[24, 35, 47] while others found no effect.[16]

Limitations of the evidence base for best-practice pain management strategies:

- Heterogeneity of studies
  - Populations vary widely (e.g. level of amputation, reason for amputation, type of pain, type of intervention), making it difficult to generalise findings.[16-18, 25, 28-30, 32, 36, 44-46, 49-52]
  - Intervention protocols differ across studies (timing, dosage), with varying levels of details provided, introducing variability in outcomes.[17, 18, 22-25, 28-30, 32, 35, 36, 44, 46, 49-53]
- Inconsistent outcome measurement
  - Pain outcomes are measured at different time points and with varying assessment tools across studies.[16-18, 23-25, 28-30, 32, 45, 49, 51-53]
- Limited high-quality evidence
  - Many conclusions rely on small randomised controlled trials and observational studies, which are underpowered and prone to bias.[16, 17, 23-25, 28-30, 32, 35, 36, 44, 46, 51-53]
  - Systematic reviews report uncertainty or conflicting results due to high risk of bias in the primary studies.[16, 18, 22, 23, 29, 32, 44, 45, 49-51]
- Gaps in the evidence
  - Limited research on postoperative pain, and RLP.

Background

Amputation is the surgical removal of a limb or extremity. There were 2,032 major limb amputations – 73 major upper limb and 1,959 major lower limb, in Australia in 2023–2024.[54] Most amputations in Australia are linked to diabetes-related complications and peripheral vascular disease. Other causes include trauma, infection and cancer. Amputation leads to long-term challenges, including mobility limitations, PLP, and increased risk of depression. Early rehabilitation and multidisciplinary care improve functional outcomes and reduce hospital stay.

Guidelines or standards of care aim to reduce complications and support recovery and rehabilitation. The 2017 Agency for Clinical Innovation *Care of the person following amputation: minimum standards of care* outlined the minimum standards of care that health services in NSW are expected to provide people facing the prospect of, or those already living with, limb loss.[37] The 2017 *Care of the person following amputation: minimum standards of care* include 12 minimum standards:

- Care is coordinated, multispecialty and interdisciplinary across all phases.
- A comprehensive care plan is developed and updated throughout the care journey.
- Counselling and psychological support is available across all stages of care.
- Referral is offered to a managed peer support program.
- Education and training on falls prevention and safety is provided to persons and their valued others.
- Discharge planning and transfer of care arrangements commence as early as possible with communication between all key stakeholders.
- A child with a congenital limb loss or limb difference requires specialist care.

- The person who has experienced an upper limb amputation requires access to a specialist upper limb amputee rehabilitation service.
- Care of the residual limb and management of risk factors for further amputation are addressed.
- Education begins in the perioperative phase and continues across all phases of care.
- Pain is assessed, managed and monitored at all stages of care.
- Special consideration is given to the needs of specific populations when managing the person with an amputation.

This evidence check will inform the review of the 2017 *Care of the person following amputation: minimum standards of care*.

Method

PubMed, Google Scholar and Google searches were conducted between 1−13 October 2025. A total of 218 guidelines and peer-reviewed studies (after removing duplicates) were screened. An additional 11 studies were identified from reference lists of included studies, and an additional guideline identified in the grey literature. See Appendix 1 for the search strategies and inclusion criteria.

Limitations

Search and selection of papers only included recent publications and guidelines from 2017 onwards. The Evidence Check might have missed key studies published before the cut-off date. Search and selection of papers only included publications reporting on healthcare systems in high income countries similar to NSW Health. The Evidence Check might have missed key studies reporting on key outcomes in low and or middle-income countries. Most of the evidence included in guidelines and studies was of low or very low quality limiting the certainty of clinical effectiveness.

This is a rapid Evidence Check that has not been developed and/or reviewed with the involvement of people with a lived experience of amputation.

Evidence tables

Table 1: Summary of identified guidelines and consensus statements

Guidelines and consensus statements	
Source	**Summary**

VA/DOD Clinical Practice Guideline for Rehabilitation of Individuals with Lower Limb Amputations (Version 3.0)
VA/DOD Clinical Practice Guideline (2025)
	• This guideline is an update from the 2017 clinical practice guide (CPG).[1] Updates included:
	  ○ increased to 26 recommendations
	  ○ stronger application of GRADE methodology
	  ○ expanded research priorities.
	• This CPG provides VA/DOD clinicians and community providers an evidence-based framework for evaluating and managing care of adult patients, 18 years or older, who have experienced LLA in VA/DOD systems.
	• Approach to care
	  ○ Patient-centred care and shared decision-making emphasised
	  ○ Coordinated care of co-occurring conditions
	  ○ Multidisciplinary Amputation Care Team (ACT): physiatrist (rehabilitation physician), physical therapist, occupational therapist, prosthetist, nurse, social worker, psychologist; expanded team includes vascular, wound care, podiatry, etc.
	• Phases of care
	  ○ Pre-amputation evaluation (prosthesis candidacy, psychosocial assessment)
	  ○ Post-amputation care (peri-operative, post-amputation rehabilitation, prosthetic training, lifelong care)
	  ○ Primary care (long-term management, limb preservation)
	• Recommendations
	  ○ Surgical technique: insufficient evidence for surgical procedure.
	  ○ Residual limb care: weak evidence for rigid and semi-rigid dressings post-transtibial amputation. Insufficient evidence for strategies to prevent re-amputation.
	  ○ Pain management: weak evidence for mirror therapy for PLP, and perineural catheter for post-operative and chronic pain. Insufficient evidence for pharmacological intervention or neurostimulation.
	  ○ Rehabilitation setting: weak evidence for inpatient rehabilitation facility preference over skilled nursing facility or home.
	  ○ Prosthetic guidance: weak evidence for osseointegration to improve prosthesis use, microprocessor knees over non-microprocessor, and energy storing and return or microprocessor-controlled feet over solid ankle cushioned heel. No clear evidence for socket design differences. Insufficient evidence for hyperhidrosis treatment.
	  ○ Outcomes: weak evidence for individualised programs, and use of screening to inform rehabilitation goals, for factors affecting outcomes (e.g. smoking, comorbidities), and the use of validated measures of functional outcome.
	  ○ Psychosocial support: weak evidence for behavioural health interventions and peer support, and patient education throughout rehabilitation. Insufficient evidence for sexual health interventions.
	• Research priorities include behavioural health, pain management and pharmacology, research populations, patient considerations

Guidelines and consensus statements	
Source	**Summary**
	and education, prosthetic interventions, rehabilitation interventions, and surgical interventions. • Most of the literature informing the recommendations was considered weak or insufficient.

VA/DOD Clinical Practice Guideline for the Management of Upper Limb Amputation Rehabilitation (Version 2.0)
VA/DOD Clinical Practice Guideline (2022)
	• This guideline is an update of the 2014 CPG.[2] It:
	  ○ includes 14 recommendations
	  ○ uses GRADE methodology (no expert opinion-only recommendations).
	• The CPG provides physicians, therapists, prosthetists and rehabilitation teams with an evidence-based framework for the care and rehabilitation for adult patients, 18 years or older, who have experienced ULA.
	• Approach to care
	  ○ Patient-centred care and shared decision-making emphasised
	  ○ Coordinated care of co-occurring conditions
	  ○ Flexible recovery process based on patient need
	• Phases of care
	  ○ Perioperative: initial evaluation, wound healing, pain control, activities of daily living training
	  ○ Pre-prosthetic: residual limb shaping, prosthetic candidacy, prescription development
	  ○ Prosthetic training: functional training, vocational reintegration, monitor complications
	  ○ Lifelong care: annual follow-up for medical, functional, prosthetic, pain, and psychosocial needs
	• Key recommendations:
	  ○ Surgery: insufficient evidence for specific surgical techniques (e.g. TMR, osseointegration), or impact of surgical technique, or demographic and clinical factors on outcomes.
	  ○ Pain management: weak evidence suggesting mirror therapy for short-term PLP reduction. Insufficient evidence for pharmacologic and non-pharmacologic pain prevention or management.
	  ○ Rehabilitation: insufficient evidence for rehabilitation training protocols, and treatment settings or intensity.
	  ○ Prosthetic guidance: weak evidence for body-powered or externally powered prosthesis for major unilateral ULA. Insufficient evidence for assessment tools for prosthetic candidacy. No clear evidence for socket design differences.
	  ○ Psychosocial support: weak evidence for screening for cognition, post-traumatic stress disorder (PTSD), depression, and pain throughout care; also for offering peer support services.
	• Research priorities include prevention and treatment of PLP and RLP, clinical assessments and outcome tools, psychosocial interventions, surgical procedures and medical interventions, and rehabilitation and prosthetic outcomes.
	• Most of the literature informing the recommendations was considered weak or insufficient.[55]

NICE Guideline: Rehabilitation after traumatic injury National Institute for Health and Care Excellence (2022)	• This guideline includes a chapter specifically on rehabilitation after limb reconstruction, limb loss or amputation.[3] • The rehabilitation after limb reconstruction, limb loss or amputation chapter includes 26 recommendations across 5 sections[3] (3 recommendations are specific for children and young people):

Guidelines and consensus statements	
Source	**Summary**
	○ Rehabilitation after limb threatening injury – early assessment, decision making and support ○ Rehabilitation after limb reconstruction ○ Rehabilitation after limb loss or amputation including pain management, residual limb oedema and shaping, range of movement and strengthening, and functional independence ○ Psychological support after limb loss, amputation or limb reconstruction ○ Continuing rehabilitation after limb reconstruction, limb loss or amputation and after discharge • Key recommendations ○ Preoperative: discuss amputation as treatment option with patient and family and carer. Specialist multidisciplinary team (MDT) carry out pre-amputation rehabilitation assessment and consultation, and discuss rehabilitation, pain management, recovery, and expectations with the patient and family and carer. ○ Postoperative: start rehabilitation as early as possible. Early mobility. Provide wheelchair and early walking aids. Implement exercise programs. Review rehabilitation plans at key points. ○ Pain management: Plan analgesia before surgery. Ensure adequate postoperative pain management. Visualisation-based interventions for PLP. ○ Residual limb care: Use elevation and compression therapy to manage oedema and shaping. ○ Psychological support: Provide psychological support across pre and postoperative and ongoing rehabilitation. • Most of the literature informing the recommendations were rated as very low using GRADE.[8]
Dutch Evidence-based Guidelines for Amputation and Prosthetics of the Lower Extremity: Amputation Surgery and Postoperative Management Dutch Association of Rehabilitation Physicians (2020)	• This guideline is an update of the 2012 CPG.[5] • This CPG provides current standards for the best care for adult patients (18 years or older) with a lower limb amputation due to vascular disease, a tumour, or trauma.[5] • The CPG provides 52 recommendations.[5] • Phases of care ○ Pre-operative assessment ○ Surgery ○ Rehabilitation ○ Prosthetic provision • Key recommendations ○ Preoperative investigations and timing: assess vascular status (e.g. duplex, ankle-arm index). Multidisciplinary decision-making for amputation level and timing. Optimise patient condition before surgery. ○ Amputation level: prefer transtibial (below-knee) when feasible for better biomechanical and prosthetic outcomes. Consider knee disarticulation only if transtibial is not possible or patient unlikely to use a prosthesis. Consider knee disarticulation if a viable alternative to transfemoral amputation. Residual limb management: rigid dressing in the operating room or recovery room (immediately postoperatively) for transtibial amputation. ○ Pain management: multimodal approach for PLP, including pharmacologic (gabapentin) and non-pharmacologic (mirror therapy) strategies.

Guidelines and consensus statements	
Source	**Summary**
	○ Prosthetic guidance: subischial socket only in patients who have stable stump shape, sufficient stump length, good vascular status of the stump and intended/current high-level ambulation. Osseointegration only in patients with non-dysvascular amputations if prosthetic use is severely limited. Auto-adaptive knee prostheses for patients with moderate ambulation and risk of falling, or patients expected to improve function and energy expenditure. ○ Rehabilitation: structured gait training programs. Shared decision-making for goal, nature, intensity and duration of program. Use validated outcome measures for mobility and participation. ○ Psychosocial support: assess psychological status pre- and post-amputation. Psychosocial interventions and patient education integrated into care. ○ Organisation of care**:** multidisciplinary collaboration (rehabilitation physician, surgeon, physiotherapist, prosthetist, psychologist). Shared decision-making with patient participation. • Most of the literature informing the recommendations were rated as low or very low using GRADE.[56]
Clinical Guidelines for the Pre- and Post-Operative Physiotherapy Management of Adults with Lower Limb Amputations, 2nd Edition Smith, Pursey (2016)	• This guideline is an update of the 2006 CPG.[4] • The CPG is an evidence-based framework for the pre- and postoperative physiotherapy management of adults with lower limb amputations.[4] • The CPG provides 113 recommendations across 6 sections:[4] ○ The role of the physiotherapist within the multidisciplinary team ○ Knowledge ○ Assessment ○ Patient and carer information ○ Preoperative management ○ Postoperative management • Approach to care ○ MDT approach is essential for optimal outcomes. ○ Physiotherapists play a central role in exercise therapy, early walking aids, compression therapy, pain management, psychological support and prosthetic referral decisions. • Key recommendations ○ Pre-operative management: early assessment and planning where possible. Provide information and reassurance to patients and carers. Teach bed mobility, transfers, wheelchair use, and initiate exercise programs. Optimise pain control before physiotherapy. Consult on amputation level. ○ Post-operative management: early assessment and rehabilitation (ideally day one postoperative). Ensure adequate pain control before each session. Ensure knowledge and familiarity with equipment. Use compression therapy (compression socks preferred; avoid elastic bandages). Early mobility, falls management, contractures education and assessment. Provide wheelchair (residual limb support, anti-tip devices) accessories and early walking aids. Implement exercise programs tailored to goals and reviewed regularly. ○ Residual limb care: wound healing, and pressure care, oedema management (rigid dressings, compression socks,

Guidelines and consensus statements	
Source	**Summary**
	pneumatic post-amputation mobility aids, avoid elastic bandage wrapping). Teach scar care and limb hygiene. ○ Pain management: provide accurate information early and teach self-management techniques. ○ Rehabilitation setting: inpatient rehabilitation preferred. ○ Psychosocial support: screen for psychological issues and cognitive impairment. Provide education on realistic goal setting and long-term expectations. Involve patients and carers in goal setting, treatment planning and exercise programs. ○ Prosthetic guidance: physiotherapists should understand prosthetic prescription principles. Prosthetic referral decisions involve MDT input. Provide prosthetic process information. • Most of the literature informing the recommendations were rated as low using GRADE.[57]
A framework for perioperative care in lower extremity major limb amputation: a consensus statement by the Enhanced Recovery After Surgery (ERAS) Society and Society for Vascular Surgery McGinigle, O'Banion (2024)	• This consensus statement provides evidence-based suggestions for coordinated perioperative care for adult patients undergoing major lower limb amputation due to nonreconstructable chronic limb-threatening ischemia.[6] • Approach to care ○ Multidisciplinary model: vascular surgeons, anaesthesiologists, advanced practice providers, rehabilitation specialists ○ ERAS principles: Minimise physiologic stress, maintain homeostasis, accelerate recovery ○ Consensus-based, not formal clinical practice guidelines, due to limited high-quality evidence ○ Optimise patient before surgery, standardise perioperative processes and ensure coordinated transitions to rehabilitation • Provides 34 best-practice suggestions across 4 sections: ○ preadmission: ○ preoperative ○ intraoperative ○ postoperative. • Key recommendations ○ Preadmission: verbal and written patient education and counselling. Screen and treat malnutrition. Identify and treat chronic anaemia. Screen for frailty and delirium risk. Screen for depression. Prescribe smoking and alcohol cessation. Evaluate and optimise comorbidities. Baseline HbA1c and treat elevated levels. ○ Preoperative: aspirin throughout preoperative period. Avoid overnight fasting. Encourage clear fluids up to 2 hours, light food up to 6 hours pre-operative. Carbohydrate loading recommended for non-diabetics and stable diabetics. Use heparin and compression devices. Use multimodal opioid-sparing regimen or outpatient pain regimen for opioid-dependent patients. Avoid routine sedatives. IV prophylaxis antibiotics 30 to 60 minutes pre-operative, redose if >4 hrs or major blood loss. Risk assessment for nausea and vomiting, use multimodal prophylaxis based on assessment. ○ Intraoperative: regional anaesthesia for pain control. Preserve knee joint when feasible. Prevent neuroma and associated PLP via epineural closure or targeted muscle reinnervation. Avoid routine surgical drains. Use negative pressure wound therapy for complex closures and/or open wounds at the stump site.

Guidelines and consensus statements	
Source	**Summary**
	○ Postoperative: multimodal analgesia to improve pain control and reduce opioids. Avoid use of urinary catheters. Maintain glycaemic control of <180 mg/dL. Provide diabetic and nutritional counselling for diabetic patients. Formal plan for early mobilisation with physical therapy involvement. No preference between soft and rigid dressings. When using rigid dressings, RRDs may be more suitable. Discharge community ambulators to acute rehabilitation hospital. Screen and refer for depression and anxiety. • Most of the literature informing the recommendations were rated as low using GRADE.
Treatment Recommendations for Phantom Limb Pain in People with Amputations: Delphi Consensus Limakatso and Parker (2021)	• A 3-round Delphi process with 27 international experts from multiple disciplines (physiotherapy, psychology, medicine, etc.) to reach expert consensus and make recommendations on the effective management of PLP. • Seven treatments that were considered effective for managing PLP: ○ mirror therapy, graded motor imagery, cognitive behavioural therapy, use of a functional prosthesis, and virtual reality training had levels of consensus ○ sensory discrimination training and amitriptyline had moderate levels of consensus. • Six of the 7 endorsed treatments are nonpharmacological. • Citalopram and dorsal root ganglion pulsed radiofrequency were considered ineffective for managing PLP.

Table 2: Summary of clinical/medical outcomes for rigid removable dressings compared to other dressings after amputation

Dressings			
Clinical/medical outcomes	**Removable rigid dressing**	**Rigid dressing**	**Negative pressure wound therapy**

Wound healing	• Two rapid reviews reported **skin-related complications or adverse events** in patients with soft dressing (not statistically significant) compared to none in patients with RRD.[9, 10]
	• Conflicting evidence regarding dressing type impact on **wound healing period**:
	  ○ A systematic, rapid and integrative review concluded that the use of RRDs reduced time for wound healing compared with soft dressing.[6, 9, 15]
	  ○ One randomised controlled trial (RCT) found that RRD reduced time for wound healing compared to soft dressing, however this was not statistically significant.[11]
	  ○ One RCT found no difference between RRD and conventional rigid dressings.[15]
		• **Wound infection** outcomes are similar between rigid dressing and other dressing (e.g. elastic bandage with knee immobiliser), in lower extremity amputations.[10, 14, 15]
		• Conflicting evidence regarding dressing type in **proportion of wounds healing and complications**
		  ○ One study reported wound healing was achieved in significantly more of the rigid dressing cohort compared to the soft dressing cohort.[14]
		  ○ One systematic review concluded that it is not clear whether rigid dressings increase the proportion of wounds healed.[38]
		  ○ Two systematic reviews concluded that it is unclear whether use of rigid dressings increase the proportion of skin or wound-related adverse events compared with soft dressings.[38, 39]
		  ○ One systematic review concluded that there was no statistical benefit of rigid dressing compared to soft dressing to wound healing.[6]
		  ○ Another systematic review concluded that wound problems and damage appeared similar in patients with rigid dressing and soft dressing.[10]
		• Conflicting evidence regarding dressing type impact on **wound healing period**:
		  ○ One systematic review and an integrative review concluded that the use of rigid dressings reduced time for
			• Significantly lower risk of a postoperative **wound infection** in the prophylactic negative pressure wound therapy compared to standard care.[41]
			• A systematic review concluded that negative pressure wound therapy reduced **time to wound healing** compared to standard care.[41]
			• A systematic review concluded that the risk of **wound complications** was statistically significantly lower in negative pressure wound therapy compared with standard care.[41]
			• A systematic review concluded that the relative risk of **wound dehiscence** was lower with negative pressure wound therapy compared to standard care.[41]

Dressings			
Clinical/medical outcomes	**Removable rigid dressing**	**Rigid dressing**	**Negative pressure wound therapy**
		wound healing compared with soft dressing.[39, 40] ○ One systematic review concluded that it is not clear whether rigid dressings decrease the time to wound healing compared with soft dressings.[38] • **Nontraumatic dehiscence** occurred significantly less frequently with rigid dressing compared to soft dressing.[14]	
Swelling and maturation	• Two systematic reviews and a narrative review concluded that RRDs resulted in significantly faster reduction of **swelling and stump volume** compared to soft dressing,[10, 11] in the short term, but not the medium term.[9 11] • A systematic review concluded based on one RCT that patients with RRD had a significantly shorter time to **residual limb maturation** compared to patients with soft dressing.[9]	• Conflicting evidence for rigid dressing reducing **swelling and stump volume**: ○ A narrative review concluded that the use of rigid dressings was consistent with less stump swelling.[40] ○ One systematic review concluded that it is not clear whether rigid dressings decrease stump swelling compared with soft dressings.[38] ○ Another systematic review concluded that there was no significant difference in the average stump volume reduction between the rigid and soft dressing.[39] • A systematic review concluded that patients with rigid dressing had a significantly shorter time to **stump maturation**.[39] • An integrative review also concluded from one RCT that rigid dressing forms a **conical shape**, which is better suited for a prosthesis than soft dressing, with less likelihood of "dog ear" skin faps.[40]	

Dressings			
Clinical/medical outcomes	**Removable rigid dressing**	**Rigid dressing**	**Negative pressure wound therapy**
Revision amputation	• Two cohort studies reported that the rate of **conversion to above knee amputation** was significantly lower in patients who received a RRD compared to those who did not.[12, 13]	• Conflicting evidence for rigid dressing reducing **revision amputation:** ○ One systematic review reported that the use of rigid dressings led to a significant decrease in the proportion of revision amputations compared to the soft dressings.[39] ○ One systematic review concluded that revision amputation was lower in RRDs compared with soft dressings.[9] ○ One systematic review reported that it was unclear whether rigid dressings reduce revision amputation compared with soft dressings.[38] ○ While another systematic review and a cohort study reported no difference in revision amputation between rigid dressing and soft dressing.[10, 14]	• A systematic review concluded that there was no statistically significant difference in relative risk of **revision amputation** between negative pressure wound therapy and standard care.[41]
Narcotic dosage	• A cohort study found **narcotic prescriptions** at discharge were significantly lower in patients who received RRD compared to patients who received non-RRD.[12]		
Non-skin related adverse events	• Conflicting evidence regarding RRD and non-skin related adverse events: ○ A narrative review concluded that rigid removable dressings enhanced protection from **falls** compared to those managed with soft dressings, and decreased the annual incidence of **external trauma to the residual limb**.[11] ○ A rapid review concluded that there was no difference between RRD and soft dressing in **deaths, medical complications and falls**.[9]	• Conflicting evidence regarding rigid dressing and non-skin related adverse events: ○ In integrative review concluded that using rigid dressings reduced **falls and trauma when falling** compared to soft dressings.[40] ○ Two systematic reviews concluded that it was not clear whether there was a difference in proportion of non-skin related adverse events (e.g. **deaths, medical complications, falls, pain**) between rigid and soft dressings.[38, 39]	

Dressings			
Clinical/medical outcomes	**Removable rigid dressing**	**Rigid dressing**	**Negative pressure wound therapy**
		○ A cohort study found that the number of **stump injuries** did not change with rigid dressing compared with soft dressing.[14]	

Table 3: Summary of health care use outcomes for rigid removable dressings compared to other dressings after amputation

Dressings			
Health care use outcomes	**Removable rigid dressing**	**Rigid dressing**	**Negative pressure wound therapy**
Length of hospital stay	• One systematic review and 2 cohort studies concluded that RRD was associated with shorter **length of hospital stay** compared with soft dressing,[9, 11, 14] and non-RRD.[11]	• Conflicting evidence regarding difference in dressing type on **length of hospital stay**: ○ One systematic review concluded that rigid dressing was associated with shorter length of hospital stay compared with soft dressing.[39] ○ One systematic review concluded that it is unclear whether rigid dressings decrease the length of hospital stay compared with soft dressings.[38] ○ One systematic review concluded that there was no difference in **length of hospital stay** between rigid dressing and soft dressing.[6]	• One systematic review concluded that there was no difference in **length of hospital stay** between negative pressure wound therapy and standard care.[41]
Time to prosthetic fitting	• A cohort study found that patients who were compliant with RRD were significantly more likely to be successfully **fitted with a prosthesis** compared to those patients who were not compliant.[11] • Conflicting evidence on RRD and time to **prosthetic casting**: ○ A narrative review found that 2 studies concluded that RRD significantly	• Conflicting evidence on rigid dressing and time to **prosthetic casting**: ○ A narrative review reported a cohort study found the percentage of patients ready to be cast was significantly greater for rigid dressing compared with soft-dressing after the first 60 days.[11] ○ An integrative review reported an RCT found patients who received a rigid	

Dressings			
Health care use outcomes	**Removable rigid dressing**	**Rigid dressing**	**Negative pressure wound therapy**
	reduced time to prosthetic casting compared to non-RRD and conventional soft dressing.[11] ○ A systematic review found that 2 studies reported significantly shorter time to casting for RRD compared to soft dressing, while another 2 studies reported no statistically significant difference.[9] • Conflicting evidence on RRD and time to **prosthetic fitting**: ○ The narrative review reported an RCT that found no difference in time to prosthetic fitting between RRD and rigid dressing.[11] ○ The narrative review reported that a cohort study found that patients with RRD had faster average time to fitting for definitive prosthesis, and date of discharge on prosthesis compared with patients with conventional soft dressing.[11]	dressing did not differ in time to casting compared with patients using other dressings.[15] • Conflicting evidence on rigid dressing and time to **prosthetic fitting**: ○ Two systematic reviews and a narrative review concluded that patients with rigid dressings had significantly shorter time to prosthetic fitting compared with patients who had used non-rigid dressings.[10, 39, 40] ○ A systematic review concluded that it was not clear whether rigid dressings decreased the time to readiness of prosthetic prescription compared with soft dressings.[38]	
Cost effectiveness	• No **cost-effectiveness** studies of RRDs versus alternative dressings for the post-operative management of people who underwent lower extremity amputation were identified.[9]		

Table 4: Summary of patient reported and functional outcomes for rigid removable dressings compared to other dressings after amputation

Dressings		
Patient reported and functional outcomes	**Removable rigid dressing**	**Rigid dressing**

Physical function	• An RCT reported that RRD and rigid dressing performed equally for **physical functioning** outcomes 3 months after amputation.[11]
	• One cohort study found the use of RRD significantly improved **ambulatory status** at follow-up compared with conventional dressing.[12]
	• A systematic review concluded that RRDs significantly reduce **joint contracture** compared to soft dressings.[9]
		• A cohort study found that **physical function** was poor for patients with immediate postoperative prosthesis.[42]
		• Conflicting evidence regarding difference in dressing type for **physical function**:
		  ○ An RCT reported that RRD and rigid dressing performed equally for physical functioning outcomes 2 months after amputation.[11]
		  ○ After amputation SIGAM mobility score was found to be better in the plaster cast cohort compared to elastic bandage and knee immobiliser.[14]
		  ○ However, one systematic review concluded that the evidence is unclear whether rigid dressings decrease time to walking compared with soft dressings.[38]
		  ○ While another systematic review concluded no significant difference between groups was found for time from amputation to time from amputation to walking.[9]
		• Patients with rigid dressings reported more **confidence** with exercising, as they felt their stump was more protected and they found transferring from one position to another easier.[40]
		• A systematic review, integrative review and cohort study concluded that rigid dressings significantly reduce **joint contracture** compared to soft dressings.[14, 39, 40]

Stump pain	• An RCT found a tendency (not statistically significant) for faster decreasing **stump pain** in RRD compared to soft dressing.[10]	• Conflicting evidence for **stump pain** reduction:
		  ○ One systematic review concluded that participants who used rigid dressing experienced significantly less pain than those who used soft dressing.[39]
		  ○ Another systematic review concluded that it was unclear whether rigid dressings decrease the time to no pain compared with soft dressings.[38]
		  ○ A study reported no significant difference between groups for time from amputation to no pain.[9]

Psychosocial	• Conflicting evidence for patient **satisfaction**:
	  ○ Patients with RRD felt comfortable and safe.[10]
	  ○ Similar levels of patient satisfaction in patients with RRDs and patients with elastic bandages.[9]
		• Patients **preferred** to continue using the rigid dressing postopratatively.[40]
		• Conflicting evidence for **psychological wellbeing** from cohort studies:
		  ○ Patients score particularly poorly in the subcategories of emotional wellbeing, and emotional functioning.[42]
		  ○ Rigid dressings have some psychological and physiological benefits for patients.[40]
		• **Clinicians** feel that rigid dressings are an improvement and prefer patients to use them.[40] Challenges include:
		  ○ heaviness of plaster casts compared to bandaging,
		  ○ need for skilled staff to apply them.[40]

Table 5: Summary of the evidence on post amputation postoperative pain management strategies

Postoperative pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**

• Perioperative **morphine** reduces immediate postoperative PLP and RLP compared to placebo.[16]
• **Ropivacaine** reduces RLP and opioid intake in immediate postoperative.[16]
• Conflicting evidence for the effect of **ketamine** on postoperative pain:
  ◦ One systematic review found that ketamine did not decrease acute postoperative pain or opioid consumption after amputation compared to other systemic analgesics.[33]
  ◦ A scoping review found oral ketamine reduced acute postoperative nociceptive pain, while IV ketamine did not significantly reduce pain.[18]
• A scoping review found no clear analgesic effect for **memantine**.[18]
	N/A	• **Fat grafting** with stromal vascular fraction reduces postoperative pain.[18]	• **Continuous peripheral nerve block** is effective for acute postoperative pain and reduces postoperative opioid use.[16-18, 33, 34]
			• **Single shot blocks**, such as single injection popliteal nerve and iliac fascia compartment blocks reduce immediate postoperative pain[16, 18] and opioid use.[16, 18]
			• **Spinal anaesthesia** is associated with fewer complications and lower opioid use compared to general anaesthesia.[16]
			• **Epidural analgesia** decreases postoperative pain[17] compared to systemic analgesics,[33] but causes more adverse effects like sedation, nausea and motor block compared with continuous perineural local anaesthetic infusion.[33]
				• Percutaneous **peripheral nerve stimulation** reduces postoperative pain and opioid requirements.[18]
				• Combined preoperative and immediate postoperative **neurostimulation + ropivacaine** reduces acute pain and opioid use.[18]

Postoperative pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**

• Conflicting evidence for the effect of **gabapentin** on postoperative pain:
  ○ A systematic review found gabapentin did not decrease acute postoperative pain when combined with epidural analgesia as compared to epidural analgesia and opioid treatment.[33]
  ○ A scoping review found mixed evidence for gabapentin on pain reduction in early postoperative period.[18]
• **Clonidine**,[16] **paracetamol** and **NSAIDs**,[17] **calcitonin**,[19] and **ketorolac**[18] may be useful in reducing postoperative pain, and postoperative opioid use.[16]				

Table 6: Summary of the evidence on post amputation residual limb pain management strategies

Residual limb pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**
• **Morphine** reduces RLP in the short term.[19] • **Lidocaine** reduces RLP.[19] • Perioperative **clonidine** does not reduce RLP long term.[16] • Conflicting evidence for the effect of **botulinum toxin** on RLP: ○ Some studies in one systematic review found that botulinum toxin reduced pain, while other studies found no change in pain following injection.[43]	• **Mirror therapy** does not reduce RLP.[23, 24] • **Virtual reality** does not reduce RLP.[24]	• **Targeted muscle reinnervation** reduces RLP.[30-32] • **Concomitant nerve coaptation + nerve wrapping** reduces the incidence of RLP compared to controls.[32] • **Regenerative Peripheral Nerve Interface** reduces the incidence of RLP compared to controls.[32]	• **Continuous peripheral nerve block** has no effect on RLP.[34] • **Epidural** bupivacaine + fentanyl + calcitonin reduces RLP allodynia and hyperalgesia compared with epidural bupivacaine + fentanyl alone, which had no effect on RLP.[45]	• There are mixed outcomes for **cerebellar transcranial direct current stimulation** on RLP.[23] • Limited evidence that **transcutaneous electrical nerve simulation** can reduce RLP.[24] • **Peripheral nerve stimulation**, including percutaneous improves RLP[16, 23] and reduces opioid use.[16]

Table 7: Summary of the evidence on post amputation phantom limb pain management strategies

Phantom limb pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**
• **Morphine** reduces PLP[22] in the short term[17, 19-21] but not long term.[20]	• Conflicting evidence for the effect of **mirror therapy** on PLP.	• **Targeted muscle reinnervation** (TMR) reduces PLP[30] compared with control/standard care[31,	• Conflicting evidence for the effect of **continuous**	• A network meta-analysis that grouped **repetitive transcranial magnetic stimulation** (rTMS),

Phantom limb pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**
• **Morphine** has a high adverse event rates,[22] and causes more side effects compared with mexiletine.[19] • **Ropivacaine**,[16] **lidocaine**,[20, 21] and **bupivacaine** are ineffective at reducing PLP.[20] • Conflicting evidence for the effect of **memantine** on PLP: ○ A systematic review and a narrative review found memantine reduced PLP in the short term,[16, 19] but not the long term.[16, 19] ○ Two network meta-analysis and a narrative review found no effect for memantine on PLP.[20-22] • Conflicting evidence for the effect of **ketamine** on PLP: ○ Two narrative reviews found that ketamine reduced PLP, but with high rates of side effects.[19, 21] ○ A systematic review and a clinical narrative	○ Two meta-analysis, 3 systematic reviews and a scoping review found that mirror therapy reduces PLP[25, 26] in the short[23, 24, 27, 29] and long term.[24] ○ A network meta-analysis found that mirror therapy was one of the best performing interventions for PLP, and that mirror therapy plus phantom exercises was the best performing treatment for PLP.[20] ○ A meta-analysis and a scoping review found that mirror therapy is as effective or more effective than **augmented reality / virtual reality** (VR/AR) in reducing PLP.[23, 26] ○ A scoping review found that mirror therapy was as effective as TENS in reducing PLP.[23] ○ A meta-analysis found that mirror therapy was superior to mental visualisation in reducing PLP, but not superior to control therapy using a covered mirror.[28]	[32] in the short and long term.[23] • **TMR** at time of amputation reduces chronic PLP compared with standard surgery.[23] • **Targeted nerve implantation** shows promise in preventing neuroma related PLP.[17] • **Traction neurectomy** shows promise in preventing neuroma related PLP.[17] • **Coblation** of femoral/sciatic nerve shows promise in reducing PLP.[17] • **Nerve coaptation and wrapping** reduces PLP,[17, 32] and neuroma formation.[17] • **Regenerative peripheral nerve interface** reduces PLP.[32]	**peripheral nerve block** (CPNB) on PLP: ○ A network meta-analysis found that CPNB ranked 3rd for chronic PLP improvement.[22] ○ A systematic review found continuous ropivacaine infusion associated with no PLP long term.[16] ○ A clinical narrative review found mixed results for perineural catheters.[17] ○ A meta-analysis found that the use of a perineural catheter showed no effect on short-term PLP.[34] • Conflicting evidence for the effect of **cryoneurolysis** on PLP. ○ A systematic review found cryoneurolysis reduced PLP and may reduce medication use.[44] ○ A scoping review found limited and inconsistent evidence for cryoablation and radiofrequency ablation on PLP.[23]	**transcutaneous electrical nerve stimulation** (TENS), **motor cortex stimulation** (MCS), and unspecified neuromodulation techniques, found these techniques did not reduce PLP compared with placebo.[20] • Conflicting evidence for the effect of **rTMS** on PLP: ○ A network meta-analysis, 3 systematic reviews, and a narrative review found short-term reduction of PLP with rTMS.[21, 22, 24, 29, 36] ○ A systematic review and a scoping review found conflicting evidence for rTMS on PLP.[23, 46] ○ A meta-analysis found no pooled benefit for rTMS in reduction of PLP.[35] • Conflicting evidence for the effect of **cerebellar transcranial direct current stimulation** (tDCS) on PLP. ○ Three systematic reviews found the tDCS reduces PLP[47] short term.[24, 36]

Phantom limb pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**
review found mixed results for ketamine on PLP.[16, 17] ○ A scoping review found no benefit of ketamine for chronic PLP.[18] • Conflicting evidence for the effect of **gabapentin** on PLP: ○ A narrative review found tentative evidence for short-term reduction of PLP with gabapentin.[21] ○ A narrative review found inconsistent evidence for gabapentin as a PLP therapy.[19] ○ Two network meta-analyses, a systematic review, and a clinical narrative review found that gabapentin did not reduce PLP.[16, 17, 20, 22] • Perioperative **valproic acid** did not reduce PLP.[16] • **Amitriptyline** does not reduce PLP[19-22] but side effects are significant.[19] • **Calcitonin** is potentially effective for acute postamputation PLP,[52] but not effective for chronic	○ Two systematic reviews and a narrative review found insufficient evidence to support the use of mirror therapy for PLP.[21, 50, 58] • **Graded motor imagery** reduces PLP,[25, 45] in the short[23, 58] to medium term.[58] • **Mental imagery** reduces PLP in the short term, and is more effective than physiotherapy.[23] • **AR/VR** reduces PLP[25, 26] after single and multiple sessions,[59] in the short term,[23, 24, 49] and reduces medication use.[24, 49] ○ AR/VR side effects are minimal – occasional minor nausea or emotional reactions early in treatment.[49] • **Combined programs**, such as machine-learning plus myoelectric control plus AR/VR[45] or VR with tactile stimulation[59] reduce PLP[45] more effectively than VR alone.[59]		○ A network meta-analysis found cryoneurolysis did not improve PLP.[22] • **Single shot nerve blocks** do not improve PLP.[16, 20] • Conflicting evidence for the effect of **epidural** analgesia on PLP. ○ A systematic review and a clinical narrative review found that continuous perioperative epidural bupivacaine + fentanyl reduced PLP in the short term, but that epidural bupivacaine + fentanyl + calcitonin was more effective in reducing PLP.[17, 45] ○ A systematic review found that epidural plus sciatic/femoral catheters reduced PLP risk compared to single catheter.[16] ○ A clinical narrative review found that epidural ketamine combined with local anaesthetic reduced PLP long term, but showed no advantage over local	○ A network meta-analysis, a meta-analysis and 2 systematic reviews found that tDCS over the motor cortex reduces PLP in the short term, [35, 46, 48] whereas cerebellar tDCS offers minimal benefit[22] and tDCS over the posterior parietal cortex shows no therapeutic effect. [46] ○ A scoping review found mixed outcomes for tDCS on PLP.[23] • Conflicting evidence for the effect of **TENS** on PLP: ○ A meta-analysis and 2 systematic reviews found that TENS reduces PLP,[24, 47] in the short term.[35] ○ A systematic review found no effect of TENS on PLP in the short term, but fewer re-amputations and faster healing in below-knee amputation patients.[16] • **Neuromuscular electrical stimulation** plus rehabilitation reduces PLP

Phantom limb pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**
PLP.[19, 52] However, ketamine is superior to calcitonin.[19] • Perioperative **clonidine** does not reduce PLP long term.[16] • **Paracetamol** and **NSAIDs** are not effective for PLP prevention.[17] • **Mexiletine** does not reduce PLP.[21, 22] • Conflicting evidence for the effect of **botulinum toxin** on PLP. ○ Some studies in one systematic review found that botulinum toxin reduced pain, while other studies found no change in pain following injection.[43]	• No standalone effect for **phantom exercise** on PLP, but phantom exercises combined with mirror therapy, or combined with neuromuscular electrical stimulation plus phantom exercise are effective for PLP.[20] • **Combined motor-based therapy** (progressive muscle relaxation plus mental imagery plus phantom exercises) reduce PLP in the short term, compared with controls,[29] and is superior to mirror therapy, rTMS, and electromagnetically shielding.[29] • **Sensory discrimination and sensory processing training** scoping reduces PLP in the short term.[23] • Conflicting evidence for the effect of **electromagnetically shielding** (EMS) on PLP: ○ A systematic review found conflicting		anaesthetic alone for PLP.[17] ○ A clinical narrative review found mixed evidence for epidural analgesia PLP long-term reduction.[17] ○ A scoping review found that preoperative epidural bupivacaine + morphine did not prevent phantom pain long term.[18]	compared with rehabilitation alone.[35] • Conflicting evidence for the effect of **spinal cord stimulation** (SCS) on PLP: ○ A systematic review and a scoping review SCS improves PLP.[23, 36] However, benefits often diminish over time, and complications such as lead migration, device failure, infection and device removal can occur.[36] ○ A systematic review found mixed evidence for spinal cord stimulation as an intervention for PLP.[51] • **Dorsal root ganglion stimulation** improves PLP short term, with pain relief waning over time.[36] • **Motor Cortex Stimulation** improves PLP, but complication such as electrode revision and neurological side effects can occur.[36] • **Deep brain stimulation** improves PLP, including chronic PLP,[35] long term,[36] but complications, such as

Phantom limb pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**
	evidence for the effectiveness of EMS limb liners on PLP in the short term.[58] ○ A network meta-analysis and a systematic review found EMS provided no benefit for PLP[22] compared with sham coverings in the short term.[29] • **Myoelectric protheses** reduce PLP.[17] • **Acupuncture** variants (auricular, scalp, electroacupuncture, contralateral acupuncture) reduce PLP[20] in the short term.[53] • No evidence that **stump wrapping, elevation, cold therapy, massage and prosthesis care** prevents PLP.[17] • Conflicting evidence for the effect of **psychological** therapies on PLP: ○ A clinical narrative review and a narrative review found no evidence for			lead revision and infection, can occur.[36] • **Peripheral nerve stimulation** (PNS) improves PLP,[16, 35] short[18] and long term[18, 23] and reduces opioid use.[16] • A network meta-analysis found that **PNS** ranked 2nd for chronic PLP improvement.[22]

Phantom limb pain				
Pharmacological	**Rehabilitation, physical and psychological therapies**	**Surgical**	**Peripheral nerve blocks / regional anaesthesia**	**Neuromodulation**
	psychological therapies in PLP prevention or management.[17, 21] ○ A scoping review found that **eye movement desensitisation** and reprocessing reduces PLP long term.[23] ○ A systematic review and a scoping review found that **hypnotherapy** may reduce PLP in the short term.[23, 58]			

Appendix

Methods

CIU Evidence Checks are not intended to be exhaustive systematic reviews (multiple databases, formal critical appraisal, etc) but instead rapid, responsive evidence summaries:[60]

- search terms for PubMed developed by evidence team and checked by clinical network
- restricting included literature to the highest levels of evidence available for a particular topic
- single reviewer screening and data extraction, with consultation in case of any uncertainty
- review of evidence check by: 2x evidence team reviews, ACI clinical network, clinical expert advisory group, 2x external peer reviewers.

Data extraction was completed in a separate Excel file which is available upon request.

CIU evidence checks include searching for literature specific to Aboriginal and Torres Strait Islander people to highlight any relevant literature or gaps in the literature as one means to work towards reducing the gap between Aboriginal and non-Aboriginal people.

PubMed search terms

1. **What guidelines are available on post-amputation care?**

   (("amputees/rehabilitation"[MeSH Major Topic] OR "amput*"[Title]) AND ("practice guideline"[Publication Type] OR "guideline"[Publication Type] OR "guidelines as topic"[MeSH Terms] OR "guideline*"[Title] OR "guidance*"[Title] OR "statement*"[Title] OR "clinical standard*" [Title] OR "clinical recommendation*" [Title] OR "clinical practice guid*" [Title] OR "clinical protocol*" [Title])) AND (2017:2025[pdat])

   37 hits on 1 October 2025

2. **Is the use of rigid removable dressings (RRD) after amputation still best practice?**

   Search 1: just about removable rigid dressing

   ("removable rigid dressing*"[Title/Abstract]) OR “rigid dressing*” [Title/Abstract] AND (2017:2025[pdat])

   10 hits on 1 October 2025

   Search 2 (should bring up clinical trials or systematic reviews and meta-analysis studies that are about all bandage and dressing options):

   (("amputation, surgical"[MeSH Terms] OR "amput*"[Title/Abstract]) AND ("Bandages"[MeSH Terms] OR "elastic" [Title/Abstract] OR "dressing*"[Title/Abstract]) OR ("rigid dressing"[Title/Abstract]) AND (clinicaltrial[Filter] OR meta-analysis[Filter] OR systematicreview[Filter]) AND (humans[Filter]) AND (english[Filter]) AND (2017:2025[pdat]) NOT ("diabetic foot"[Title/Abstract] OR "ulcer"[Title/Abstract] OR “open fractures”[Title]))

   22 hits on 1 October 2025

3. **What are best-practice pain management strategies following amputation?**

   (("amputation, surgical"[MeSH Terms] OR "amput*"[Title/Abstract]) AND ("pain management"[MeSH Terms] OR "pain management"[Title/Abstract])) AND ((systematicreview[Filter]) AND (humans[Filter]) AND (english[Filter]) AND (2017:2025[pdat]))

   21 hits on 1 October 2025

Aboriginal health lens search terms

AND ("indigenous"[Title/Abstract] OR "aboriginal"[Title/Abstract] OR "first nation*"[Title/Abstract] OR "native*"[Title/Abstract])

0 hits for Q1, Q2, and Q3 on 10 June 2026

Google search terms

1. **What guidelines are available on post-amputation care?**

   Google and Google Scholar were searched using the key term “amputee amputation guideline statement standard recommendation protocol” on 10 October 2025. Searches were confined to post 2017. Only the first 3 pages of the search results were screened (30 results from Google Scholar, 30 results from Google).

2. **Is the use of rigid removable dressings (RRD) after amputation still best practice?**

   Google and Google Scholar were searched using the key term “removable rigid dressing amputation amputee” on 13 October 2025. Searches were confined to post 2017. Only the first 3 pages of the search results were screened (30 results from Google Scholar, 30 results from Google).

3. **What are best-practice pain management strategies following amputation?**

   Google and Google Scholar were searched using the key term “amputation amputee pain management systematic review” on 13 October 2025. Searches were confined to post 2017. Only the first 3 pages of the search results were screened (30 results from Google Scholar, 30 results from Google).

Inclusion and exclusion criteria

Inclusion	Exclusion
Published in English Published since 2017 (publication of the ACI minimum care standards) **P**opulation: Acquired major limb amputations (trauma, burns, workplace, diabetes, post sepsis, cancer) **I**ntervention: **Q2 -** Removable rigid dressing **Q3 -** Postoperative pain management, phantom limb pain management, residual limb pain management **C**omparison: **Q2 -** Rigid dressings, soft dressings **O**utcomes: **Q2 -** Clinical outcomes, patient reported outcomes, healthcare utilisation **Q3 -** Pain **S**tudy types: **Q1** ○ Guidelines and consensus statements with transparent methods	• Published prior to 2017 • Studies that do not meet **PICOS** criteria • Purely qualitative evaluations • Letters, comments, editorials, study protocols, conference abstracts • Care of people born with congenital limb difference • Fingertip amputation, penile amputation

Inclusion	Exclusion
Q2 ○ Review studies with systematic search strategy and methods ○ Randomised or non-randomised clinical trials ○ Before and after studies, time series studies with/without a comparison group ○ Retrospective chart review studies ○ Interventional/evaluative studies presenting quantitative data ○ Evaluative studies with quantitative or qualitative assessment of outcomes with/without a comparison group ○ Grey literature such as guidelines and consensus statements **Q3** ○ Meta analyses, systematic reviews, scoping reviews, narrative reviews **S**etting: ○ NSW, Australia and international jurisdictions with healthcare systems similar to NSW Health (UK, Canada, New Zealand, European/Asian high-income countries with public healthcare systems) ○ Inpatient, outpatient, community, in-reach, after-hours access	

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