Postgraduate Certificate in Spinal Cord Injury Rehabilitation

Orthotics And Prosthetics

Orthosis – a device that supports, aligns, prevents, or corrects deformities of the musculoskeletal system. In the context of spinal cord injury (SCI) rehabilitation, orthoses are frequently used to provide stability to weakened or paralyzed segments, facilitate safe transfer, and enable functional standing and ambulation. For example, a thoraco-lumbo-sacral orthosis (TLSO) may be prescribed to a patient with high-thoracic injury to maintain an upright trunk posture during wheelchair transfers. The primary challenge in orthosis prescription is balancing rigidity for support with enough flexibility to allow residual voluntary movement and prevent secondary complications such as skin breakdown.

Prosthesis – an artificial device that replaces a missing body part, most commonly a limb. In SCI patients who have sustained an amputation, the prosthesis must be integrated with the orthotic strategies used to manage the remaining neurological deficits. A lower-limb prosthesis for a paraplegic individual may incorporate a specialized foot component that stores and releases energy to compensate for reduced muscular power during gait. The fitting process is complicated by altered sensation, spasticity, and the need for customized socket designs that accommodate pressure-sensitive skin.

Socket – the interface between the residual limb and the prosthetic device. The socket is responsible for load transmission, suspension, and comfort. Modern socket fabrication often utilizes digital scanning and computer-aided design/computer-aided manufacturing (CAD/CAM) to achieve precise geometry. However, for SCI patients with fluctuating limb volume due to autonomic dysreflexia or edema, a conventional plaster cast may be preferred because it allows rapid adjustments. A common challenge is achieving an optimal balance between a snug fit that prevents pistoning and sufficient space to avoid skin irritation.

Suspension system – the method by which a prosthesis is attached to the residual limb. Options include suction, pin, lock-and-pin, and soft-socket (liner) suspension. In individuals with impaired proprioception, a suction suspension may provide a more secure attachment because it reduces reliance on tactile feedback. Conversely, a pin suspension can cause skin puncture and is often avoided in patients with fragile tissue. Selecting the appropriate system requires an assessment of skin integrity, limb geometry, and the patient's activity level.

Alignment – the spatial relationship of prosthetic components relative to the body's biomechanical axes. Correct alignment ensures efficient gait, reduces energy expenditure, and minimizes joint stress. For a patient with a low-lumbar injury who uses an AFO (ankle-foot orthosis) in conjunction with a prosthetic knee, the alignment of the knee joint must consider the altered gait pattern caused by reduced trunk control. Misalignment can lead to compensatory hip hiking, increased fall risk, and accelerated prosthetic wear.

Dynamic orthosis – an orthosis that allows controlled movement while providing support. Examples include hinged knee orthoses (HKO) and functional electrical stimulation (FES)-integrated devices. In SCI rehabilitation, a dynamic HKO may be employed to assist a patient with incomplete motor function in achieving a more natural knee flexion during stance. The primary challenge is calibrating the hinge resistance to match the patient's residual strength without causing instability.

Static orthosis – a rigid device that restricts movement to protect injured structures. A thoracic-lumbar brace used immediately after a high-level cervical injury is a typical static orthosis. While it offers maximal protection, prolonged use can lead to muscle atrophy, decreased joint range of motion, and reduced cardiovascular conditioning. Clinicians must therefore plan a timely transition to more dynamic devices as the patient's neurological status improves.

Anterior tibial orthosis (ATO) – a specific type of ankle support that controls dorsiflexion and plantarflexion. In the SCI population, an ATO may be combined with a prosthetic foot to provide additional ankle stability for patients with partial ankle control. The orthosis is often fabricated from low-profile thermoplastic to minimize bulk, which is crucial when fitting within the prosthetic shoe.

Anterior cruciate ligament (ACL) – while not a prosthetic component, understanding the ACL's role is essential when designing knee prostheses for SCI patients. An ACL-sacrificing prosthetic knee may be appropriate for individuals who lack active quadriceps control, as the device can provide anterior stability mechanically. However, sacrificing the ACL can increase the risk of hyperextension injuries if the patient regains strength unexpectedly.

Knee joint types – various mechanical configurations used in prosthetic knees. The main categories include single-axis, polycentric, mechanical lock-release, and microprocessor-controlled knees. For a patient with a T12 injury who retains some hip extension, a polycentric knee may be advantageous because it mimics the natural swing-phase arc, reducing the need for compensatory hip strategies. Microprocessor knees, while offering superior adaptability, require reliable power sources and may be contraindicated in individuals with compromised hand function needed for battery management.

Foot components – the distal part of a lower-limb prosthesis that interfaces with the ground. Common designs include solid ankle cushion heel (SACH), energy-storing foot (ESF), and dynamic response foot. An ESF is particularly beneficial for SCI patients who lack active push-off power, as it stores kinetic energy during stance and releases it during toe-off. The downside is that ESFs are often heavier and may increase the overall mass of the prosthesis, affecting balance for patients with limited trunk control.

Material properties – characteristics such as stiffness, fatigue resistance, and weight of orthotic and prosthetic components. Carbon fiber, for instance, offers high stiffness-to-weight ratio, making it ideal for lightweight prosthetic feet. However, carbon fiber's low damping can transmit vibrations to the residual limb, potentially aggravating neuropathic pain in SCI patients. Thermoplastic materials like polyethylene terephthalate (PET) are easier to modify and are often used for temporary orthoses while the patient's condition stabilizes.

Biomechanics – the study of forces and motions within the human body. In orthotics and prosthetics, biomechanics informs the design of devices that optimize load distribution and minimize joint stress. For example, a biomechanical analysis may reveal that a paraplegic patient's prosthetic knee experiences excessive shear forces during the stance phase, prompting the selection of a knee joint with enhanced mediolateral stability. The challenge lies in performing accurate biomechanical assessments in patients who cannot provide reliable voluntary movement data.

Load-bearing capacity – the amount of weight that an orthotic or prosthetic component can safely support. In SCI rehabilitation, the load-bearing capacity must account for the patient's potential reliance on the device for weight-bearing activities such as standing transfers. A TLSO rated for 150 kg may be selected for a patient who intends to use a standing frame for daily exercise. Over-specifying the capacity can increase device weight unnecessarily, while under-specifying it risks structural failure.

Gait analysis – a systematic evaluation of walking patterns, often using motion capture, force plates, and electromyography. For SCI patients fitted with lower-limb prostheses, gait analysis helps identify asymmetries caused by neurological deficits and informs adjustments to prosthetic alignment, foot stiffness, or orthotic support. The practical challenge is that many gait labs require the patient to ambulate over a short distance, which may not be feasible for individuals with limited endurance; portable gait analysis tools may be employed instead.

Standing frame – a device that supports the patient in an upright position, often used for bone health, pressure relief, and urinary management. When combined with a custom orthosis, a standing frame can promote better postural alignment for patients with high-level injuries. However, the interface between the frame and the orthosis must be carefully designed to avoid shear forces on the skin, especially in individuals with reduced sensation.

Exoskeleton – a powered, wearable orthotic device that assists or initiates movement. In the SCI setting, exoskeletons are increasingly used for gait training and cardiovascular conditioning. The device's control algorithms must be adaptable to the patient's level of injury; for a C5-C6 tetraplegic, the exoskeleton may need to incorporate hand-controlled inputs because upper-limb function is limited. Challenges include battery life, device weight, and the need for extensive therapist training.

Assistive technology (AT) – a broad category encompassing devices that enhance independence. Orthotic and prosthetic devices are a subset of AT. For example, a powered wheelchair with a tilt-in-space function can be considered AT that complements a lower-limb prosthesis by reducing the need for manual transfers. Integration of multiple AT devices requires careful coordination to avoid conflicting control interfaces.

Skin integrity – the condition of the skin covering the residual limb or areas in contact with orthoses. Maintaining skin integrity is paramount because SCI patients often have compromised sensation and vascular supply. Regular skin inspections, pressure mapping, and the use of breathable liners can prevent ulceration. A common problem is the development of "socket dermatitis" caused by friction and moisture buildup, which may necessitate a temporary switch to a softer liner.

Pressure mapping – a technique that visualizes the distribution of pressure across the skin–device interface. In prosthetic fitting, pressure mapping can identify high-pressure zones that could lead to skin breakdown. For instance, a pressure map of a transtibial prosthetic socket might reveal a peak over the fibular head, prompting a socket modification such as a relief cut or the addition of a gel liner. The limitation is that pressure mapping devices add time and cost to the fitting process.

Residual limb volume management – strategies to control fluctuations in limb size due to fluid shifts, muscle atrophy, or weight changes. In SCI patients, autonomic dysreflexia and spasticity can cause rapid swelling, making socket fit unstable. Techniques include scheduled socket adjustments, use of adjustable socket systems, and patient education on limb elevation and compression garments. Failure to manage volume changes can result in poor prosthetic control and increased fall risk.

Spasticity – a velocity-dependent increase in muscle tone common after SCI. Spasticity can affect prosthetic fitting by causing involuntary limb movement that destabilizes the socket. An orthosis with a hinged ankle may be employed to accommodate spastic ankle plantarflexion, while a prosthetic knee with a lock-release mechanism can prevent knee buckling during sudden muscle spasms. Pharmacologic management (e.g., baclofen) may be required in conjunction with device adjustments.

Functional independence – the ability to perform activities of daily living (ADLs) without assistance. Orthotic and prosthetic devices are evaluated based on their contribution to functional independence. Outcome measures such as the Functional Independence Measure (FIM) can quantify improvements after device prescription. A challenge is that many standardized measures do not fully capture the nuanced benefits of assistive devices for SCI patients, necessitating supplemental qualitative assessments.

Outcome measures – tools used to assess the effectiveness of orthotic and prosthetic interventions. Common instruments include the Prosthesis Evaluation Questionnaire (PEQ), Orthotics and Prosthetics User Survey (OPUS), and the International Classification of Functioning, Disability and Health (ICF) framework. For SCI patients, outcome measures should incorporate both physical performance and psychosocial factors, such as satisfaction with device aesthetics and perceived autonomy.

K-level classification – a system that categorizes prosthetic users based on their functional potential, ranging from K0 (non-ambulator) to K4 (high-activity). While originally designed for amputees, the K-level concept is adapted for SCI patients to guide component selection. A K2 classification may be assigned to a paraplegic individual who uses a prosthetic leg for limited community ambulation, influencing the choice of a SACH foot rather than an ESF. Misclassification can lead to inappropriate component selection and reduced satisfaction.

ASIA Impairment Scale – a standardized neurological assessment that grades sensory and motor function after spinal cord injury. The scale informs orthotic and prosthetic decision-making by indicating the level of residual motor control. For example, a patient classified as ASIA C at the T12 level retains some motor function in the lower extremities, which may allow the use of a dynamic AFO combined with a prosthetic knee. Conversely, an ASIA A patient with complete motor loss will require a more supportive orthosis to achieve safe standing.

Motor level – the lowest spinal segment with functional motor activity. Determining the motor level is essential for selecting appropriate orthotic devices. A patient with a motor level at L2 may have hip flexor strength sufficient for initiating swing, allowing a prosthetic knee with a stance-phase lock. However, weakness at L3–L4 may necessitate a hip orthosis to prevent excessive pelvic tilt during gait.

Sensory level – the lowest spinal segment with preserved sensory function. Sensory level influences socket design because areas below the sensory level may be insensate, increasing ulcer risk. A prosthetic socket for a patient with a sensory level at T10 should incorporate pressure-relieving features such as gel pads over bony prominences, and the orthosis should be padded to protect the torso.

Pelvic tilt – the angle of the pelvis in the sagittal plane. Abnormal pelvic tilt is common in SCI patients due to weakened trunk musculature. Orthotic interventions such as a lumbosacral orthosis can help maintain a neutral pelvic position, which in turn improves prosthetic gait symmetry. Failure to control pelvic tilt can result in compensatory hip hiking and increased energy expenditure.

Postural control – the ability to maintain alignment of the head, trunk, and limbs. In SCI rehabilitation, postural control is often compromised, especially in high-cervical injuries. A custom-made thoracic orthosis can serve as a scaffold for trunk stability, enabling the patient to sit upright and engage the prosthetic knee more effectively during gait training. Training programs that combine orthotic support with core strengthening can enhance postural control over time.

Balance – the capacity to keep the center of mass within the base of support. Prosthetic components such as microprocessor knees can improve balance by adapting resistance in real time, but they require reliable sensor input, which may be compromised in patients with reduced proprioception. Therapists often use balance boards and perturbation training to teach SCI patients how to use visual cues and vestibular input to compensate for diminished somatosensory feedback.

Weight-bearing – the act of supporting body weight through the lower limbs. In SCI patients, weight-bearing may be limited to the upper limbs or assisted through assistive devices. Orthotic devices like a HKAFO (hip-knee-ankle-foot orthosis) enable partial weight-bearing for patients with incomplete injuries, facilitating bone health and muscle activation. The challenge is to prevent over-loading of the residual limb, which can cause pain or skin breakdown.

Functional mobility – the ability to move safely and efficiently in various environments. Prosthetic and orthotic prescriptions aim to enhance functional mobility, allowing patients to navigate home, community, and work settings. A well-fitted prosthetic leg combined with a dynamic ankle orthosis can enable a patient with a T6 injury to transfer from wheelchair to bed without assistance. However, environmental factors such as uneven terrain and lack of accessible ramps remain barriers to functional mobility.

Gait training – a structured program to teach or re-teach walking. In SCI rehabilitation, gait training may involve body-weight-supported treadmill training, over-ground practice, and the use of robotic exoskeletons. Prosthetic gait training focuses on synchronizing the prosthetic limb with the residual limb's motor patterns, while orthotic gait training may emphasize proper use of AFOs or KAFOs to achieve a stable stance. Common obstacles include fatigue, fear of falling, and difficulty integrating sensory feedback.

Prosthetic training phases – a progression of skill acquisition from basic donning and doffing to advanced community ambulation. Phase 1 typically involves socket fitting and static balance tasks. Phase 2 introduces dynamic activities such as controlled stepping. Phase 3 emphasizes endurance and terrain negotiation. For SCI patients, the timeline may be extended due to reduced cardiovascular capacity and limited motor control. Adequate documentation of each phase is essential for insurance reimbursement and interdisciplinary communication.

Reconditioning – the process of restoring muscle strength, endurance, and cardiovascular fitness after injury. Orthotic and prosthetic devices can either facilitate or hinder reconditioning. A lightweight carbon-fiber prosthetic foot reduces energy cost, encouraging longer walking sessions, whereas a heavy steel ankle may limit endurance. Reconditioning programs must be individualized, taking into account the patient's autonomic dysreflexia risk and potential for spasticity exacerbation during exercise.

Patient education – instruction provided to the individual and caregivers about device use, maintenance, and safety. Effective education includes teaching proper donning and doffing techniques, skin inspection routines, and troubleshooting common problems such as socket loosening. For SCI patients, education should also address the impact of temperature on thermoplastic orthoses, battery management for powered prostheses, and the signs of over-use injuries. Inadequate education often leads to device misuse, increased complication rates, and reduced adherence.

Compliance – the degree to which patients follow prescribed device usage. High compliance is associated with better functional outcomes. Factors influencing compliance include device comfort, aesthetic appeal, ease of use, and perceived benefit. A prosthetic socket that requires frequent adjustments may reduce compliance, especially if the patient experiences recurrent skin irritation. Strategies to improve compliance involve regular follow-up appointments, patient-centered design choices, and incorporating user feedback into device modifications.

Outcome assessment tools – instruments used to measure changes in function, quality of life, and device satisfaction. The PEQ, for example, assesses prosthetic satisfaction across domains such as ambulation, appearance, and residual limb health. The OPUS evaluates orthotic outcomes, including comfort, durability, and effectiveness in daily tasks. When applying these tools to SCI patients, clinicians must consider that many items assume intact sensory feedback, which may not be present; therefore, adaptations or supplementary qualitative interviews are often necessary.

Biomechanical modeling – computational simulation of forces and motions within the musculoskeletal system. In orthotics and prosthetics, modeling can predict how changes in socket geometry or component stiffness affect gait dynamics. For an SCI patient with a C7 injury using a standing exoskeleton, biomechanical modeling helps determine the optimal torque settings to prevent excessive lumbar loading. The limitation of modeling is the need for accurate input data, which can be difficult to obtain from patients with limited voluntary movement.

CAD/CAM technology – computer-based design and manufacturing processes that produce custom orthotic and prosthetic components. Digital scans of the residual limb are converted into three-dimensional models, which are then milled or 3-D printed. This technology shortens production time and improves fit accuracy. However, for patients with fluctuating limb volumes, a static CAD/CAM socket may become ill-fitting within weeks, necessitating a hybrid approach that combines digital design with adjustable socket features.

Thermoplastic orthoses – devices made from heat-moldable polymers such as polyethylene or polypropylene. Thermoplastics are popular because they can be reshaped in the clinic to accommodate changes in patient anatomy. A TLSO fabricated from low-temperature thermoplastic can be adjusted during follow-up visits without the need for a new cast. The downside is that thermoplastic orthoses may be less durable than carbon-fiber alternatives, especially under high impact conditions.

Carbon-fiber components – lightweight, high-strength materials used in both orthotics and prosthetics. Carbon-fiber AFOs provide rigidity while allowing a thin profile, which is advantageous for patients who need to fit the orthosis inside a prosthetic shoe. Nevertheless, carbon fiber can be brittle under repeated impact, and cracks may be difficult to detect without specialized equipment. Regular inspection protocols are essential to prevent sudden failure.

Adjustable sockets – socket systems that incorporate mechanisms such as ratcheting straps, silicone liners, or modular panels to accommodate volume changes. For SCI patients experiencing daily limb swelling due to autonomic dysreflexia, an adjustable socket can maintain a consistent fit, reducing the need for frequent remakes. The trade-off is that adjustable systems may add bulk or create pressure points if not carefully aligned.

Suspension liners – soft, compressible sleeves that line the interior of a prosthetic socket. Liner materials range from silicone to polyurethane, each offering different levels of shear resistance and moisture management. In patients with reduced sensation, a silicone liner provides a secure grip and distributes pressure evenly, but it may retain heat, increasing the risk of skin maceration. Selecting the appropriate liner requires assessment of the patient's skin condition, activity level, and environmental factors.

Power sources – batteries or other energy supplies that drive powered prosthetic components. Lithium-ion batteries are common due to their high energy density and relatively low weight. For SCI patients with limited hand dexterity, battery replacement may be challenging; therefore, devices with easy-click charger ports or wireless charging options are preferable. Battery life must be balanced against device weight, as larger batteries increase the prosthesis's mass, potentially affecting gait stability.

Microprocessor control – electronic systems that adjust prosthetic joint behavior in response to sensor inputs. A microprocessor knee can modulate resistance during stance and swing phases, providing smoother transitions for patients with variable gait patterns. In SCI rehabilitation, microprocessor knees can compensate for inconsistent muscle activation caused by spasticity, but they require reliable sensor placement and may be sensitive to electromagnetic interference from other medical equipment.

Exoskeletal gait trainers – robotic devices that guide lower-limb movement in a repetitive, controlled manner. These trainers are used to re-establish stepping patterns in patients with incomplete SCI. The device's parameters (step length, speed, load) can be customized to match the patient's current capabilities. A challenge is that the transition from exoskeletal training to independent prosthetic ambulation may be difficult if the patient becomes dependent on the robot's assistance.

Functional electrical stimulation (FES) – the application of electrical currents to elicit muscle contraction. FES can be integrated with orthoses to enhance foot dorsiflexion during swing, reducing the need for a rigid AFO. For SCI patients with incomplete motor pathways, FES may improve muscle strength and promote neuroplasticity. However, electrode placement is critical, and skin irritation can occur if the electrodes are not properly secured.

Pressure-relief pads – localized cushioning placed within a socket to off-load high-pressure areas. Materials include gel, foam, and air-filled bladders. In a paraplegic patient with a residual limb that has a bony prominence over the tibial crest, a pressure-relief pad can prevent ulcer formation while preserving overall socket stability. The pad must be periodically inspected for wear and displacement.

Gait symmetry indices – quantitative measures that compare the timing and force of the prosthetic limb to the intact limb. Indices such as the Symmetry Ratio or the Gait Deviation Index help clinicians assess how well a prosthetic device restores balanced walking. For SCI patients, achieving perfect symmetry may be unrealistic due to underlying neurological deficits; nevertheless, improvements in symmetry are associated with reduced energy cost and lower fall risk.

Fall risk assessment – systematic evaluation of factors that increase the likelihood of a fall. Tools such as the Berg Balance Scale or the Timed Up and Go test are adapted for SCI patients. In addition to standard balance measures, clinicians must consider orthotic and prosthetic issues such as socket fit, joint locking mechanisms, and device weight. Mitigation strategies include adjusting prosthetic alignment, adding ankle stability, and providing targeted balance training.

Rehabilitation team communication – the coordinated exchange of information among physicians, orthotists, prosthetists, physical therapists, and occupational therapists. Effective communication ensures that device prescriptions are aligned with the patient's overall rehabilitation goals. For example, a physical therapist may note that a patient's hip abductor strength is insufficient for a certain prosthetic knee, prompting the orthotist to modify the socket's medial wall. Documentation platforms must be used consistently to avoid misinterpretation.

Insurance authorization – the process of obtaining coverage approval for orthotic and prosthetic devices. Documentation must include detailed clinical justification, functional goals, and evidence of need. In the SCI population, justification often centers on preventing secondary complications such as pressure ulcers and osteoporosis. Delays in authorization can impede timely device delivery, adversely affecting rehabilitation progress.

Componentry selection – the decision-making process regarding which specific parts (e.g., foot, knee, liner) are appropriate for a given patient. Componentry must be matched to the individual's activity level, residual limb condition, and functional goals. A high-activity K4 patient may benefit from a carbon-fiber ESF and a microprocessor knee, whereas a low-activity K1 patient may be adequately served by a simple SACH foot and a mechanical lock knee. Over-prescribing advanced components can increase cost without proportional functional gain, while under-prescribing can limit independence.

Weight distribution analysis – assessment of how load is shared between the prosthetic and intact limbs, as well as between the residual limb and the socket. In SCI patients with limited trunk control, uneven weight distribution can exacerbate pelvic tilt and increase energy expenditure. Using force plates or instrumented insoles, clinicians can identify asymmetries and adjust prosthetic alignment, socket padding, or orthotic support accordingly.

Training of donning and doffing – teaching the patient how to correctly put on and remove orthotic or prosthetic devices. Proper technique reduces the risk of skin injury and device damage. For a tetraplegic patient, a caregiver may be trained to assist with a complex prosthetic leg that includes a microprocessor knee and an energy-storing foot, ensuring that each component is aligned before each use. Failure to follow correct procedures can lead to misalignment, increased fall risk, and premature wear.

Maintenance schedule – a plan outlining routine inspections, cleaning, and part replacement. Prosthetic components such as pylons, foot plates, and knee joints have specific service intervals. Orthotic devices may require periodic re-adjustment of straps or replacement of padding. Adherence to a maintenance schedule is crucial for device longevity and patient safety, particularly for SCI patients who may have limited ability to recognize early signs of wear.

Environmental considerations – factors such as temperature, humidity, and terrain that affect device performance. Thermoplastic orthoses may soften in hot climates, reducing rigidity, while carbon-fiber components can become brittle in cold environments. Prosthetic feet with rubber soles may wear quickly on rough surfaces, necessitating more frequent replacement. Tailoring device selection to the patient's typical environment improves durability and functional reliability.

Psychosocial impact – the effect of orthotic and prosthetic devices on a patient's self-image, confidence, and social participation. A well-designed prosthetic leg can enhance body image and encourage community engagement, whereas a bulky orthosis may cause embarrassment and lead to device abandonment. Incorporating patient preferences for color, style, and visibility into the prescription process can improve acceptance and adherence.

Regulatory standards – guidelines governing the safety and efficacy of orthotic and prosthetic devices. Agencies such as the FDA (Food and Drug Administration) and ISO (International Organization for Standardization) set requirements for material testing, labeling, and clinical evaluation. Clinicians must ensure that devices prescribed for SCI patients meet these standards, especially when using emerging technologies like powered exoskeletons.

Research and evidence-based practice – the integration of current scientific literature into clinical decision-making. Studies comparing microprocessor knees to mechanical knees in SCI populations demonstrate improvements in gait symmetry and reduced fall rates, supporting their use in higher-functioning patients. However, evidence also indicates that increased device complexity may not translate to functional gains for individuals with severe motor deficits, highlighting the need for individualized assessment.

Future directions – emerging trends that may reshape orthotics and prosthetics in SCI rehabilitation. Topics include neural interfacing, where prosthetic devices are controlled directly by cortical signals, and smart fabrics that provide real-time feedback on pressure and temperature. While promising, these technologies present challenges related to cost, training, and long-term durability in the context of altered neurological function.

Interdisciplinary case study – an illustrative example that integrates many of the terms discussed. A 34-year-old male with a T9 complete injury (ASIA A) sustained a transtibial amputation following a traumatic accident. The rehabilitation team performed a comprehensive skin assessment, identified a high-risk pressure area over the residual limb's fibular head, and selected a silicone liner with a pressure-relief pad. A CAD/CAM-fabricated socket was produced, incorporating adjustable panels to accommodate daily volume fluctuations. A K2-level prosthetic foot (SACH) was chosen due to the patient's limited ambulatory goals. A TLSO was prescribed to support trunk posture during transfers. The patient received education on socket hygiene, daily skin inspection, and proper donning techniques. Over six weeks, gait analysis showed improved symmetry, and the PEQ indicated high satisfaction with the combined orthotic-prosthetic system. Challenges encountered included occasional skin irritation from the liner, which was resolved by switching to a breathable polyurethane material, and occasional battery failure of the microprocessor knee (which was later replaced with a mechanical lock knee after reassessment of functional needs).

The terminology outlined above forms the foundational vocabulary for clinicians working in the field of orthotics and prosthetics within spinal cord injury rehabilitation. Mastery of these concepts enables precise assessment, individualized device prescription, and effective interdisciplinary collaboration, ultimately advancing patient outcomes and promoting independence.