NSW State Spinal Cord Injury Service

New South Wales
Statewide Spinal Cord Injury Service

Skin Care and Pressure Area Prevention in Patients with Spinal Cord Injury ©

This bridging document contains excerpts that are linked to the educational content of the Spinal Seating Professional Development Program.
http://www.health.nsw.gov.au/gmct/spinal/sspdp/ssm/Module_08/part_1.html

Consensus Document

Ratified by Statewide Spinal Cord Injury Service
Clinical Development Committee
2007

Document for Review October 2008
Document Published April 2008

April 2008

Module 8, part 1:

Incidence, prevalence, and recurrence

Pressure ulcers are often reported as one of the most frequent secondary complications in SCI patients (McKinley et al, 1999) (Cardenas et al, 2004) (Fourney et al., 2002). Other common causes of skin related readmissions in spinal patients include cellulitis and burns (Middleton et al, 2004). It is important that each health care facility know their specific incidence and prevalence rates. This would allow for national comparisons, and provide a benchmark for evaluating prevention and management initiatives. A thorough understanding of prevalence and incidence statistics, including the reasons for skin breakdown, would allow for initiatives to be targeted toward areas of need (Ratliff and Rodeheaver, 1999) (Cardenas et al, 2004).

One recent Australian study explored spinal-related readmissions to Royal North Shore Hospital. They found that pressure sores accounted for only 6.6% of readmissions, however contributed to a disproportionately large number of bed days (27.9%). A large focus of their study was exploring pressure ulcer related readmissions, and their findings were as follows;

- Level and completeness of injury appeared to be important predictive factors for readmission
- For individuals under the age of 45 paraplegics developed more pressure sores requiring readmission compared to tetraplegics, however the opposite was the case for individuals older than 45
- Paraplegics accounted for a greater proportion of total pressure ulcer readmissions
- For all age groups, individuals with an ASIA A impairment were most likely to be readmitted
- Young male paraplegics between the ages of 16 and 29 were at particular risk for readmissions (Middleton et al, 2004)

Less than half of the readmissions (84 of 192 readmissions) identified above were to the SCI unit at RNSH. This highlights the importance of pressure ulcer awareness across all hospital units, including non-specialist hospitals (Middleton et al, 2004).

Sharp et al (2000) conducted a study of 850 registered nurses working in New South Wales (most of whom where either clinical nurse specialists or clinical nurse consultants), and found that the majority of nurses (79%) sampled generally did not use an assessment tool to determine a patients risk of pressure ulcer development. Over half of surveyed nurses were using outdated practices for the prevention and management of pressure ulcers, such as water-filled gloves, and soap and water. Less than half of respondents used support surfaces, such as alternating mattresses, to help prevent pressure ulcer development. To further compound this problem almost half used turning regimens of greater than 2 hours. These findings are concerning in regards to the provision of appropriate care, but also indicate a potential lack of continuity of care as there is no commonly adhered to best practice.

NSW Health has mandated that local facilities are required to develop local pressure ulcer prevention/ management guidelines.

The policy has directed that each health service should:

- Develop guidelines for the availability and maintenance of support surfaces and specialised equipment for the prevention of pressure ulcers
- Develop pressure ulcers prevention strategies based on this circular and the clinical practice guidelines
- Monitor, assess and evaluate these strategies
- Collect, analyse and distribute data
- Report on pressure ulcers prevention strategies against targets and outcomes.

(NSW Health, 2005)

Module 8, part 2:

Neurologically intact skin compared with neurologically impaired skin

Individuals with SCI have neurologically impaired skin. They may experience decreased elasticity of the skin due to an interference of the catabolism and biosynthesis of the skin. This will reduce the tensile strength of the skin below the level of injury, making it more susceptible to injury (Caliri, 2005). Studies have found that normal skin can withstand ischemia for up to three hours longer than skin below the level of SCI (McDonald, 2001). Once the skin is damaged, the prevention of a pressure ulcer becomes more difficult (Fries, 2005).

Table 16. Comparison of neurologically intact vs. impaired skin
(Level of Evidence – V)

Factor	Neurologically intact skin	Neurologically impaired skin
Elasticity	Good	Reduced
Tensile strength	Good	Reduced
Resistance to ischaemia	Good	Reduced by up to 3 hours
Resistance to physical insult (eg. friction, heat)	Good	Reduced
Muscle bulk	Good	Muscle atrophy
Sensation	Good	Reduced
Maintenance of constant body temperature	Good	Altered
Reflex skin vascular changes	Good	Impaired below level of lesion

Module 8, part 3:
Underlying principles of pressure ulcer prevention

Prevention strategies should aim to address predisposing risk factors, reduce and control pressure on high risk areas, support the healing of an existing wound and aim to prevent reoccurrence (Preston, 2003). Some of these strategies have been summarised in Table 2 below.

Table 2. Underlying principles of pressure ulcer prevention

Pressure ulcer prevention principle	Explanation
Risk assessment	Conduct systematic and consistent assessment of pressure ulcer risk factors of individuals with SCI (see Appendices 1,2 & 3).
Skin inspection	This should be conducted twice daily paying particular attention to areas at greatest risk of pressure ulcer development (McDonald, 2001).
Return to Seating Protocol	Progressive increased tolerance to seating after a period of immobilisation (see Appendix 4).
Pressure relief	**Immobility is the most significant risk factor for pressure ulcer development.** The mobility limitations of SCI potentially lead to prolonged periods of immobilisation, causing ischemia. When implementing prevention initiatives it is important to address body positioning, turning and repositioning, and the use of pressure relieving devices. (Ratliff and Rodeheaver, 1999) (WCANSW, 2002) (Rubayi, 2003) (Fries, 2005).
Continence management	Incontinence must be addressed and managed in order to prevent excess moisture.
Skincare hygiene	Ensure a hygienic environment to allow for maintenance of skin integrity in order to avoid skin breakdown.
Nutrition	Oral intake must be monitored, and referral to a dietitian should occur if intake appears to be inadequate or excessive (NSW Health, 2004; Ratliff and Rodeheaver, 1999; Frost, 1999).
Evaluate environment	Ensure individual is in an environment which enables skin maintenance. Minimise humidity and maintain appropriate room temperature. Use moisturisers to rehydrate the skin where necessary (Ratliff and Rodeheaver, 1999).
Equipment prescription	All equipment requires expert prescription. This includes wheelchair, cushions, mattresses, commodes, hoists, slings, and other items that may exert pressure on the patient's skin (Frost, 1999).
Exercise regimen	To promote maintenance of skin integrity, increase strength of muscles, improve cardiovascular endurance, and prevent fatigue and de-conditioning. Consider the impact of pain on mobility and activity (Preston, 2003).
Education	Specific information on effective strategies for the prevention and treatment of pressure ulcers directed to patients, carers, health professionals, and significant others.
Seeking advice	If further input is required to assist in the overall management of skin, seek professional advice from relevant health care providers (see Appendix 5).

Risk assessment (Table 2)

In 2005, NSW Health issued a policy directive making it mandatory that a pressure ulcer risk assessment be conducted on all inpatients, and for those people seen on domiciliary nursing visits. All risk assessment results are required to be documented in order to make them accessible to all members of the multidisciplinary team. Documentation should also include interventions used and associated outcomes in order to monitor changes in the patient's condition (NSW Health, 2004) (EPUAP, 1998) (NSW Health, 2005).

In NSW there are a range of risk assessment tools being used. Some examples of tools validated for the general population include: Waterlow (See Appendix 1), Braden (see Appendix 2), Norton, and NSW Health's Pressure Sore Prediction Score. However no validated tool has been specifically designed for the SCI population (Preston, 2003), although the Waterlow was found to have highest predictive value in patients with SCI when compared to the Braden and Norton scales (Wellard and Lo, 2000).

Risk assessment tools are intended to quantify risk, however the resultant score should not replace clinical judgement, and should serve only as a guide (Maylor, 2006). Attached (see Appendix 3) is a guide of preventative measures that should be implemented for patients identified at various levels of risk. It should be noted that a risk assessment score should not lead to a prescriptive and inflexible approach to patient care (EPUAP, 1998).

It is necessary to identify patients at risk of pressure ulcer development in order to provide timely preventative care (Papanikilaou et al, 2003) (NSW Health, 2004). When in hospital, patients should be assessed for the risk of developing a pressure ulcer using a validated risk assessment tool (including a nutritional assessment) at the following times:

- Within 6 hours of admission
- During waiting periods in excess of 6 hours in the emergency department (eg. for transfer to operating theatre)
- Post operatively
- Whenever there is a clinical change in a patient's condition. Those with unstable conditions will require more frequent risk assessment
- Once every 24 hours after initial assessment

(NSW Health, 2004) (Niezgoda and Mendez-Eastman, 2006) (Peerless et al, 1999) (NICE, 2001) (Ratliff and Rodeheaver, 1999)

Skin inspections (Table 2)

Routine skin inspections are essential for effective pressure ulcer prevention (Peerless et al., 1999). Only persons who have received appropriate training and who are able to recognise early signs of skin damage should conduct the inspection. Such a person may be the patient, a carer, or a health care professional. Self examination should be encouraged in individuals with sufficient motor and cognitive function. Long handled mirrors can be used to aid skin inspection (NSW Health, 2003b).

All patients with SCI should inspect/ have skin inspected at least twice daily (McDonald, 2001). The current NSW Health policy states that all patients with SCI admitted to Area Health facilities must receive more frequent, third hourly skin inspections (NSW Health, 2004). As pressure relief for bed bound patients is recommended every 2 hours, it is practical to inspect the skin every time the patient is repositioned. Frequent observation will allow for the early identification of new pressure ulcers, and follow-up of existing wounds (Frost, 1999).
Results of all skin inspections should be documented in the patients notes to monitor any changes in skin condition (NSW Health, 2003b) (EPUAP, 1998).

It is common to see reddened areas of the skin after a period of sitting/ lying, however in undamaged skin with adequate vascular supply, red areas should resolve within 30 minutes of total pressure relief. If this does not happen, then necrosis has occurred and a pressure ulcer has developed (McDonald, 2001).

Basic guide for assessing early stages of skin damage:

1. Apply light finger pressure to the area for 10 seconds.
2. Release the pressure. If the area is white and then returns to its original colour, the area probably has an adequate blood supply. Observation should continue and preventative strategies should be employed.
3. If on release of pressure, the area remains the same colour as before pressure was applied, it is an indication of the beginning of pressure ulcers development and preventative strategies should be employed.
4. If there is an alteration in skin colour (redness, purple or black), increased heat or swelling, it may imply underlying tissue breakdown. Frequency of assessment should be increased.
5. With dark skin pigmentation, pressure ulcer development will be indicated by areas where there is localised heat, or where there is damage, coolness, purple/ black discolouration, localised oedema and induration.

(NHSQIS, 2005)

An important aspect of skin inspection is the removal of compression stockings to check the heels (Revis, 2006). This should be attended as part of the routine skin inspection regimen. Figures 1 – 4 below indicate areas of the body in various anatomical positions that are at higher risk for skin breakdown. Skin breakdown may still develop in areas not indicated on the figures.

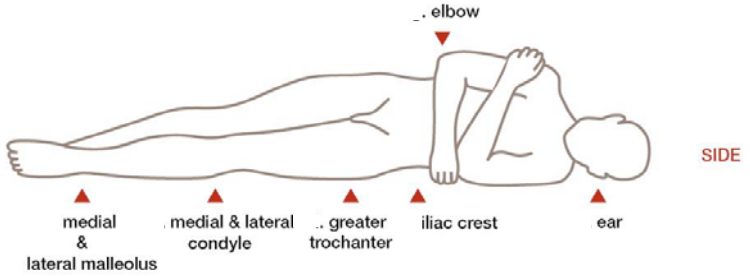


Fig.1 Anatomical risk for pressure ulcer development (VQC, 2004):

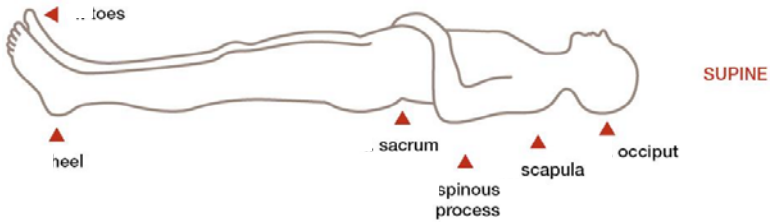


Fig.2 Anatomical risk for pressure ulcer development (VQC, 2004):

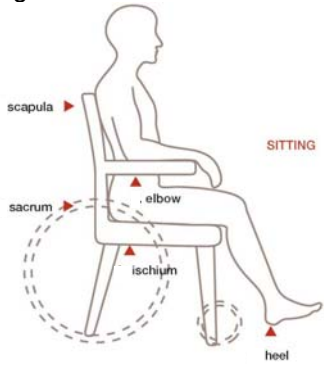


Fig.3 Anatomical risk for pressure ulcer development (VQC, 2004):

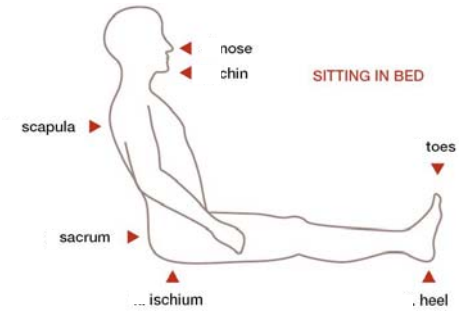


Fig.4 Anatomical risk for pressure ulcer development (VQC, 2004):

Return to seating protocol (Table 2)

After a SCI, a range of factors such as altered body mechanics, loss of soft-tissue bulk, and changes to the skin, necessitate gradual development of sitting tolerance. Seating protocols should begin in the intensive care unit if the spine is stable (Peerless et al, 1999), as this will allow for the rapid identification of abnormal autonomic responses triggered by the change in position (Orthostatic hypotension) (Karlsson, 2006). Some associated benefits with early implementation of a return to seating protocol includes improved bowel motility, psychological benefits (Peerless et al, 1999), and an opportunity to commence rehabilitation and regain fitness.

During SCI rehabilitation, patients should participate in a progressive seating plan. In order to promote maximum participation in daily life, the goal of a seating plan is to attempt to promote skin tolerance of a minimum of 8 hours in a wheel chair. Once this is achieved, the patient's skin should be able to withstand a normal day of work or social activities in the wheelchair. This is important in allowing the patient to gain a maximum level of independence. Such a seating plan will require pressure relieving devices and weight shifting schedules (Frost, 1999).

A progressive seating plan should also be implemented following bedrest for a pressure ulcer, or when new pressure management equipment is being trialed. The SSCIS have a "Return to Seating" protocol which is implemented after the skin has healed from any form of skin breakdown (see Appendix 4).

Pressure relief (Table 2)

All patients with a SCI are at risk of pressure ulcer development. When hospitalised all patients should receive care on appropriate support surfaces and/ or specialised equipment (NSW Health, 2004) (NSW Health, 2005). Patients with unstable spinal columns should not receive care on alternating surfaces.

Appropriate body positioning is a relatively simple, and effective way to decrease pressure over bony prominences (Ratliff and Rodeheaver, 1999). Pillows and foam wedges can be used (NSW Health, 2003b) (McDonald, 2001) (Frost, 1999). As heels are at high risk of pressure ulcer development, specially designed boots can be used as an aid to reduce pressure (Fries, 2005) (NSW Health, 2003b).

Level of injury has a great effect of one's ability to reposition. Other contributing factors include completeness of injury, secondary injuries (such as shoulder/ arm injuries), weight, and concordance with repositioning regimens (WCANSW, 2000).

Reduced joint mobility may be a problem in achieving some repositioning goals. There is benefit in regularly changing joint position (consensus) through an active or passive program. Due to paralysis in patients with SCI, this will often be passive with the assistance of a caregiver. An active lifestyle should be promoted as it has many benefits,

including increased oxygen availability. It can also increase strength which can lead to improved transfer ability, weight shifts, bed positioning, and general mobility (McDonald, 2001).

The use of draw sheets to reposition patients with SCI should be avoided due to shearing and friction forces on the skin (NICE 2001). Material slide sheets can be used as a helpful turning aid for healthcare workers. They are made of slippery material that slides easily on itself, minimum effort is then required to turn the patient (NSW Health, 2003c) (Ratliff and Rodeheaver, 1999). Slide sheets comply with OHS regulations as they minimise manual handling efforts.
Linen should be promptly changed if the patients bedding or clothes become wet or soiled, and bottom bed sheets should be kept dry and fitted in a way to avoid creasing (Frost, 1999). In cases where an alternating air cell mattress or other device is used, the manufacturer's instructions regarding the use and type of bed linen should be strictly adhered to.

Difficulties arise with repositioning when a patient is asleep. Alternating air mattresses are a potential solution, as they provide pressure relief during sleeping hours (WCANSW, 2002). However, appropriate mattresses and wheel chair cushions do not eliminate the need for repositioning, but only serve as an adjunct to care (Ratliff and Rodeheaver, 1999). Even with a specialised surface/ mattress, the importance of turning and repositioning cannot be overemphasised (Revis, 2006) (NSW Health, 2003c).

Pressures exerted on the body are significantly different when in bed compared to when seated (i.e. wheelchair, car, commode, aircraft etc). Table 3 summarises these differences.

Table3. Repositioning recommendations for bed and chair

	Bed	Chair
Areas under greatest pressure	**Supine**: toes, heels, tail bone, sacrum, elbow, shoulder blades, back of head **Side lying**: ear, shoulder, pelvis, hip, knee, ankle bones	The two points typically under greatest pressure are the areas under the two ischial tuberosities (Tam et al., 2003; Ratliff and Rodeheaver, 1999). Also individual factors such as chair size, cushion choice, and posture of the patient can cause the greater trochanters, coccyx, or sacrum to be subject to high pressure; however the spinous process and soles of feet are also vulnerable areas.
Repositioning/ pressure relief	**Every 2 hours** (where this is not possible pressure relief must occur every 3 hours)(NSW Health, 2004) (Committee consensus)	**Preferably every 15 minutes** (if not possible pressure relief must occur hourly). Pressure relief should occur for at least one second for every minute of unrelieved sitting (i.e. 15 seconds pressure relief for 15 minutes of unrelieved sitting). (McDonald, 2001)
Repositioning technique	Repositioning should involve a range of anatomical positions, however avoid positioning directly on the greater trochanter (Ratliff	Push-ups in chair, tilt in space wheelchairs, or forward/ side leans. Repositioning must consider what is effective for pressure relief

	and Rodeheaver, 1999) (NSW Health, 2003b) (EPUAP, 1998). Positions include: 30 degrees using pillows and foam wedges or prone/ supine (Fig. 10)	of the individual's at-risk areas, and can be done independently, or with readily available assistance.
Contra-indicated practices	Where the patient's condition allows, avoid having the head of the bed raised more than 30 degrees. High positioning of the head of the bed places the patient at greater risk of damage due to friction, sheer. Some mattresses can tolerate having the head of the bed raised, however others cannot and will no longer provide pressure relief (McDonald, 2001) (Frost, 1999) (Peerless et al, 1999).	Doughnut shaped devices should be avoided as they are known to cause venous congestion and oedema, and therefore increase the risk of pressure ulcer development (Ratliff and Rodeheaver, 1999).
Common considerations	An appropriate patient repositioning regimen is influenced by a range of individual factors including skin condition, oxygen availability to the tissues, medical stability, sensory status, physical abilities, and current support surface (WCANSW, 2002).	
	Repositioning intervals must be individualised using clinical judgement and regular skin checks. Intervals must be reduced if skin checks identify early signs of damage (Thomas, 2006). Conversely, if skin is able to withstand current duration of sitting/ lying, intervals can be slowly increased, and equipment can be gradually downgraded (McDonald, 2001).	
	In order to prevent pressure ulcers, both the duration and intensity of pressure must be minimised (Peerless et al., 1999).	
	Each phase of care will have unique considerations when determining repositioning intervals, and must be taken into account during care delivery.	

Pressure relief surfaces (Table 2)

Regular repositioning alone has not actually been proven to be an effective means to reduce pressure ulcer development (Cullum et al, 2006). It is therefore important that repositioning is used in conjunction with appropriate support surfaces, both when in bed and when seated. Appropriate support surfaces should be chosen based upon the patient's individual risk factors and the overall management plan. Re-evaluation must occur whenever a patient's condition improves or worsens (Salcido, 2005).

Not one study has found any one pressure reducing/ relieving device (for bed or chair) to be more effective than another under all circumstances. However, the majority of specialised support surfaces have been shown to reduce tissue pressure in comparison to a conventional hospital mattress and standard wheelchair cushions (Revis, 2001) (Revis, 2006) (Salcido, 2005) (Ratliff and Rodeheaver, 1999).

Health care facilities need to ensure they have access to appropriate support surfaces relevant to the level of risk of their overall patient population. This will be achieved through the purchasing/ hiring of equipment, (Prentice and Stacey, 2001). Hiring of equipment can be seen as a short term solution that could be implemented to allow for provision of appropriate care (Gunningberg, 2005) (Prentice and Stacey, 2001) (Pearson et al., 2000).

Support surfaces can be divided into two distinct categories: alternating pressure devices and static pressure devices (NSW Health, 2003b) (Salcido, 2005). Additionally there is a clear distinction between surfaces required for lying and sitting. Therefore patients with a SCI will require assessment and prescription of devices specific for bed and wheelchair, and perhaps other surfaces they may commonly sit/ lie upon (for example: commodes, car seats, lounge chairs, and the floor).

Alternating pressure devices are dynamic support surfaces consisting of numerous cells that alternatively inflate and deflate. These devices aim to relieve pressure to below the capillary closing pressure in the areas when the cells are deflated, thus allowing the blood to flow freely in that area. These devices have the potential to reduce repositioning schedules, thus causing fewer interruptions to the patient. The disadvantage of such devices is the cost, the requirement of a power source, and potential discomfort for the patient (NSW Health, 2003b) (Salcido, 2005).

Constant low pressure devices include a range or products, both powered and non-powered. These may be made of/ or filled with foam, water, gel, fibre, air, or beads. These devices are often cheaper than alternating pressure devices, and may/ may not require a power supply (NSW Health, 2003b) (Salcido, 2005). Constant low pressure devices act to reduce tissue pressures in comparison to a standard hospital mattress or standard wheelchair cushion; however some areas will still be above the capillary closing pressure. Although they reduce pressure, regular repositioning is still necessary.

A systematic review of six Randomised Controlled Trials found pressure relieving foam mattresses to be beneficial in reducing the incidence of pressure ulcers in a non-spinal population. The mattresses were evaluated in comparison to standard hospital mattresses (Cullum et al., 2006). The consensus of the committee is that patients with stable spines and identified to be at high risk of skin breakdown, have increased benefit by using high level pressure relieving mattresses.

The use of sheepskin coverings to relieve pressure and prevent tissue damage has very limited supporting evidence. They may enhance patient comfort but should not be used on top of alternating air mattresses or pressure relieving cushions as this negates the pressure relieving benefits.

It is not recommended to use water-filled gloves, bandages, pads, or 'doughnut' devices in an attempt to relieve localised pressure points. Such measures may simply enlarge the area of excessive pressure, or further compromise local blood circulation (Ratliff and Rodeheaver, 1999).

Pressure relief surfaces - bed (Table 3)

Table 3 can be used to ensure that appropriate support surfaces are used in accordance to a patient's level of risk. Table 4 provides examples of mattress types that may be suitable for patients with a SCI. It is recommended that you should contact the NSW Independent Living Centre www.ilcnsw.asn.au for local suppliers.

Table 4. Pressure ulcer support surfaces related to level of skin breakdown risk

Mattress	Risk assessment score (as per validated scales)	Considerations

Alternating pressure air mattress (APAM) replacement system	Very High Risk Or established skin breakdown	- Availability of Transport mode (a mattress function) - Mattress goes directly on bed base - Check patient can maintain independence - Maintain strict turning regimes - No sharps or smoking in bed - Head of bed must not be elevated past 30 degrees with exception of meals
Alternating pressure air mattress (APAM) overlay system	High Risk Or established skin breakdown	- Availability of transport mode - Mattress to be placed upon existing bed mattress - Check patient can maintain independence - Maintain strict turning regimes - No sharps or smoking in bed - Head of bed must not be elevated past 30 degrees with exception of meals
Mattress replacement system – static (Foam, air, gel, combination other)	Medium Risk	Maintain condition of mattress as per manufacturer's recommendations
Mattress overlay – static (Foam, air, gel, combination other)	Low Risk	Maintain condition of mattress as per manufacturer's recommendations

The information in Table 4 should not be used exclusively as the method of assessing the appropriateness of a pressure care support surface as there are a number of physical, social and environmental factors that should also be considered such as the patient's level of injury, size, weight and age of the patient, type of care setting, availability of resources.

Pressure relief surfaces - chair (Table 3)

Wheelchairs

Effective pressure management depends on suitable selection of wheelchair, posture management devices and pressure management cushions. In addition, good pressure management also depends on correct adjustment of these components to suit specific patient needs. Pressure management is only one factor to be considered in the choice of a suitable wheelchair, and compromises across a number of aspects may be necessary to achieve a good outcome.

The height of the wheelchair footrests (and the heel height of shoes) affects seating pressures. In general, raising the footrest height (or heel height) increases seating pressures, and lowering the feet reduces seating pressures. Having the footrests too low is better than having them too high (NSWSSCIS, 2005a).

The wheelchair design and options can be a major factor in the ability of the client to independently relieve pressure

In general, changes to the setup of a wheelchair should be made only by clinicians with skills and expertise in seating prescription. Periodical expert seating reviews are important as small changes in seating can cause significant changes in pressure distribution (McDonald, 2001). A seating review should occur at least every 5 years or if there is significant change to the patient's condition (eg. skin breakdown, postural change, weight changes) or when a new wheelchair or other equipment is being considered/ trialed.
(Level of evidence – consensus)

Pressure management cushions

Patients with compromised sensation require specialised cushions when seated (McDonald, 2001) (Frost, 1999). They may also need specific cushions for other forms of seating (particularly in motor vehicles). These are typically foam, air cells or gel bags.

Individual variations in skeletal anatomy, tissue wasting, body mass and mass distribution require a range of cushion types to achieve acceptable results. Cushion prescription must be individualised as there is no direct relationship between cushion construction and pressure reduction, or SCI lesion level. Furthermore, the cushion must not only reduce pressure risks, but should meet the user's requirements for comfort, bodily stability, postural support and functional needs (such as facilitating safe self-transfers). For these reasons, patients with SCI should not purchase standardised (off the shelf) seating solutions without assistance of a health care professional skilled in seating.

A cushion assessment usually involves trials of the cushion using the patients' own wheelchair (or motor vehicle etc as the case may be). Apart from pressure management, considerations include patient comfort, ability to transfer, ability to maintain the cushion (checking correct inflation), and vulnerability of the cushion to damage in the patient's situation.

The cover of a pressure management cushion should be made of a material recommended and supplied by the manufacturer. This should be a four way stretch which is loose but neatly fitted over the cushion. **Do not use sheets, pillowcases, towels or sheepskin** over a pressure management cushion as these materials do not stretch, causing increased seating pressures (NSWSSCIS, 2005a).

Loss of or damage to a pressure reducing cushion can have devastating effects potentially leading to skin breakdown. It is therefore strongly recommended, that every patient with SCI using a pressure management cushion, should have a second cushion of the same type. Appendix 6 briefly outlines some of the types of cushions available for use.

Repositioning technique – chair (Table 3)

It is important that patients with SCI can perform pressure relief in their wheelchairs without requiring assistance. Various pressure relief techniques are illustrated below (Fig. 5-10). Patients should adopt the technique(s) that are effective in achieving very low pressure and preferably those that can be performed with minimum effort and joint loading. The critical issue is that pressure is relieved with adequate regularity. The consensus of the committee is that pressure should be relieved every 15 minutes, and that the duration of relief should be at least one second for every minute of unrelieved sitting.

Assisted pressure relief can be effective but the frequency of pressure relief required can place heavy demands on carer availability, if the patient with SCI is unable to relieve pressure independently. Wheelchairs with manually operated seat tilt may be appropriate for pressure relief when the constant presence of an attendant is not assured (eg. a manual chair used only when visiting friends/ family).

Manual wheelchair design is important in providing hand grip points for safe lifting and leaning with minimal stress to arms and shoulders.

Patients with SCI who have insufficient physical ability to reposition themselves should be provided with a powered wheelchair with seat tilt ('tilt-in-space') controlled by the user (Fig. 9). The angle of tilt should be at least 50 degrees to promote the best pressure relief. With some patients, there will be little pressure relief even at extreme angles of tilt and it may be necessary to have a combination of powered seat tilt and powered

backrest recline to achieve effective independent (or assisted) pressure relief. Where powered tilt (with or without backrest recline) is required (typically with spinal lesions at a high level), special adaptations of the seat tilt/ backrest recline control system may be required for the user to maintain control at large tilt angles.

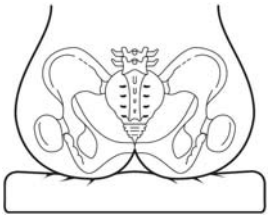


Fig. 5 Seated normally in chair

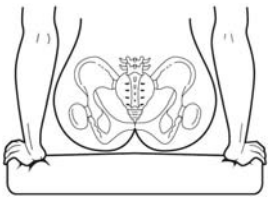


Fig. 6 Repositioning technique - 'Push up'

NB. This technique is contra-indicted in patients with certain cardiac conditions

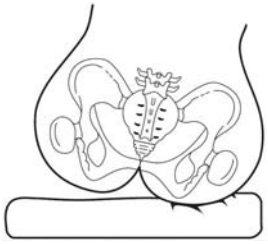


Fig. 7 Repositioning Technique - 'Side Lean'

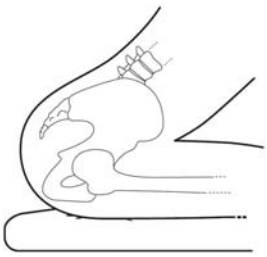


Fig. 8 Repositioning Technique - 'Forward Lean'

Fig. 9 Repositioning Technique - 'Tilt n Space' seating

Fig. 10 Repositioning in bed with 30^{o} angle (CSCM 2000)

Continence management (Table 2)

Neurogenic bladder/ bowel dysfunction caused by SCI usually manifests itself as urinary/ faecal incontinence (failure to store) or urinary/ faecal retention (failure to empty) or a combination of both (Giroux 2001). The person with failure to store may present with continual urinary/ faecal leakage whilst the person with failure to empty may present with intermittent leakage. Both have implications for the patient's skin integrity due to maceration/ excoriation caused by the presence of moisture and the pH of the excrement. Preventing moisture, maceration/ excoriations should be a primary concern in the plan of care for all persons with SCI (Thomason, 2001). See skin care hygiene below.

Following SCI, it is imperative that all patients are placed on bladder and bowel management programs. These should be drafted in consultation with the patient and a nursing/ medical spinal specialist. The goal of bladder and bowel management programs are to ensure complete and regular emptying in the absence of complications (i.e. incontinence, trauma, infection, time to complete care). Bladder and bowel management programs may consist of a combination of mechanical/ behavioral and pharmaceutical interventions individualized to the patient, taking into consideration their level and type of injury, functional independence, motivation and lifestyle.

When moisture cannot be controlled, absorbent briefs should be used to provide a quick-drying surface next to the skin (Ratliff and Rodeheaver, 1999).

Gently cleanse skin at time of soiling if there is excessive moisture or incontinence. Topical agents that act as barriers to moisture should be used. Devices such as plastic and draw sheets should not be used as they interfere with the pressure redistributing surfaces. (EPUAP, 1998) (McDonald, 2001) (Ratliff and Rodeheaver, 1999) (Preston, 2003) (Revis, 2006) (O'Connor, 2006)

Skincare hygiene (Table 2)

Interventions to prevent skin breakdown include maintaining and improving tissue tolerance by:

1. Maintaining skin hygiene
2. Controlling humidity
3. Avoiding temperature extremes
4. Applying moisturisers to dry skin
5. Avoiding massage to reddened areas or bony prominences. (Massage continues to damage already damaged capillaries).
6. Controlling moisture

Regular showering/ bathing promotes normal skin functioning and removes contaminants and dead skin. To minimise excessive dry and scaly skin irritations, select mild non perfumed soap. Always dry skin thoroughly especially between toes, as wet skin is more susceptible to breakdown. It is not advised to apply lotions or alcohol rubs routinely (Zejdlik 1992). Avoid massage over bony prominences, excessively hot water when bathing, harsh cleansing agents, excessive force and friction when cleaning (EPUAP 1998, Frost 1999, O'Conner 2006, Ratcliff & Rodeheaver 1999).

Moisture and solutions can collect in skin folds/ creases and cause irritation, therefore it is important to daily inspect these areas, eg. groin, under breasts, under belly, gluteal folds and underarms.

Any presence of moisture/ maceration/ excoriation should be treated with moisture barrier cream, or moisture barrier cream combinations. Consider low air loss support surface for moderate to severe maceration/ excoriation (Thomason, 2001).

Following bowel and bladder procedures, ensure that the perineal area is cleaned, rinsed and thoroughly dried. If the penis appears excoriated through the use of an external urinary collection device, remove the device to allow for skin recovery for a period of 48 hours (Zejdlik, 1992). An indwelling catheter can be inserted temporarily to avoid incontinence.

Perineal care is an important part of personal care for comfort and prevention of skin break down in both male and female patients with SCI. In the female patient with SCI, excoriation of the perineal area may be caused by frequent use of antiseptic solutions that are used with clean intermittent self-catheterisation (CISC) regime. The area should be cleansed with normal saline or sterile water according to skin tolerance, avoiding harsh solutions. For the daily placement of the leg bag, women with an indwelling catheter should alternate leg sides, to avoid pressure on labia minora (Zejdlik 1992).

Local infections, for example vaginitis or urethritis can cause irritation. Specific systemic or topical medications will control the cause. (Committee consensus)

Due to autonomic nervous system dysfunction and lack of sweat production, the skin on the lower limbs of patients with SCI is prone to dryness. Lack of normal wear and tear can lead to an excessive accumulation of hardened skin on feet. It is not uncommon for cracks, cuts and calluses of the feet to occur. Therefore feet should always be included in general skin inspection. Application of lanolin based cream can assist with this problem. Monitor skin between toes for splits and fungal infections. Antifungal applications should be used in the presence of yeast infections (Zejdlik 1992). Ingrowing toenails can cause pressure along side the nail bed. Long, hardened thickened toenails require attention by careful, straight across trimming with clippers.

It is important to wear shoes for protection against injury from dragging and bumping. A correct shoe size is essential to avoid pressure. Shoes often need to be one size larger than normal to compensate for gravitational oedema (Committee consensus).

Nutrition (Table 2)

It is often assumed there is a direct causal relationship between nutrition and pressure ulcer development. The scientific basis for this assumption is unclear as there are no sound studies linking impaired nutrition and an increased incidence of pressure ulcers (Langer et al, 2003). However, decreased calorie intake and a drop in serum albumin may decrease the tolerance of skin and underlying tissues to extrinsic factors as pressure, friction and shearing force, increasing the risk of skin breakdown and reducing wound healing (Muller et al, 2001). Low albumin levels have however, been implicated as a predictor of pressure ulcer risk (Williams et al, 2000).

Malnutrition has been reported as being positively correlated with pressure ulcer incidence and severity (Berlowitz and Wilking, 1989; Bergstrom and Braden, 1992; Ratliff and Rodeheaver, 1999; Revis, 2006; Strauss and Margolis, 1996), and is therefore an important factor in both the prevention and treatment of pressure ulcers.

Best practice entails monitoring the nutritional status of individuals as part of a holistic assessment procedure, and as an ongoing process throughout a patient's episode of care. All patients with SCI determined to be at risk of a pressure ulcer should be assessed for nutritional risk (Peerless et al, 1999; Casey, 1998b). Unfortunately there are no validated nutrition screening or assessment tools for patients with SCI in any setting. However there are factors common in all nutritional assessments that can be applied to patients with SCI who present with pressure ulcers. Initially, an assessment should include:

- Current height and weight
- Recent weight loss – >10% unintentional weight loss in past 6/ 12 months or >5% in past month is indicative of poor nutritional status (EPUAP, 2003)
- Usual eating habits

- Recent changes in eating habits
- Biochemical parameters – EUC/ FBC/ LFTs/ Pre albumin.

If nutritional risk is suspected a more detailed assessment and intervention process should be undertaken. Nutritionally compromised individuals should be referred to a dietitian to provide expert input to support decision making.

Evaluate environment (Table 2)

Ensure the patient is in an environment which enables skin maintenance and reduces the risk of skin breakdown:

Patients with SCI at and above the T6 level are unable to regulate their own body temperature thereby taking on the temperature of the surrounding environment; this condition is known as poikilothermia (Fahey, 2002). Extreme heat can cause excess sweating, and extreme cold can trigger spasm. Both spasm and sweating can increase the risk of pressure ulcer development. Reverse cycle air conditioners are recommended to help patients control their own body temperature (Committee consensus).

The home environment needs to be considered from the perspective of insulated and temperature regulated hot water pipes to prevent burns and appropriately sized rooms and passageways to ensure feet, hands or elbows do not bump into walls. Steps around the home should be avoided to minimise risk of falls/ skin trauma, (Committee consensus) and the electricity supply should be able to manage the additional demands from electrical equipment such as alternating air mattresses, wheelchair battery chargers etc.

The work environment should be assessed for the above points as well as ensuring that the work station is set up to minimise shearing/ friction. It is imperative that the workplace bathroom is accessible and a shower recess is available in the case of incontinence issues (committee consensus).

When using a vehicle, there are some additional considerations to protect the skin. These include such things as cushions specific for car travelling, method of transferring, use of seat covers for vinyl/ leather seats and position of air conditioning vents (risk of burns from excess heat). (Committee consensus).

Extreme weather conditions and high altitudes will alter the consistency, firmness and inflation pressures of a wide variety of cushions and mattresses. This must be considered when prescribing cushions and mattresses. Similarly, using commercial airflights effects the inflation levels of air cushions. It is advisable that the patient carry his/ her own air pump during any flight to regulate inflation levels as cabin pressure changes. (Committee consensus).

Equipment prescription (Table 2)

The prescription of all equipment for patients with SCI requires expert advice. Equipment of greatest concern in regards to pressure ulcer development include: wheelchairs, cushions (Frost, 1999), mattresses, commodes, hoists, slings, and other items that may exert pressure on the patient's skin. It is necessary to trial each piece of equipment prior to prescribing to ensure that it meets the need of the patient with SCI. (Committee consensus).

Exercise regimen (Table 2)

A well planned exercise regime aims to promote maintenance of skin integrity, increase strength of muscles, improve cardiovascular endurance, and prevent fatigue and deconditioning. Planning is also important for the consideration of pain on mobility and activity (Preston, 2003).

Exercise has positive benefits for all aspects of health and well-being. It brings cardiovascular benefits in terms of efficiency of oxygen delivery to organs including the skin, and it builds muscle tone and strength enabling efficient and safe functional tasks such as transfers, to be easily integrated into daily life. Tasks requiring endurance, such as prolonged wheelchair propulsion, will be assisted through a graduated exercise regime, and in turn, bring benefit to the skin in terms of efficiency of oxygen delivery and uptake. In addition, the psychological benefits of exercise are well documented and assist in optimising energy levels and conditioning.

Education for skin management and pressure ulcer prevention (Table 2)

Education about skin care and skin management is of utmost importance for all involved, including health professionals, service providers, carers, and patients. Correct skin care practices must be used in conjunction with appropriate specialist equipment. Education initiatives must cover preventative skin care practices, specialist equipment appropriate use, and skin management in the event of a developing/ existing wound.

Education of health professionals

Education is especially relevant to nursing staff who play a pivotal role in pressure ulcer prevention (Fries, 2005) and clinicians have a responsibility to keep up to date with current recommendations on best practice for the treatment of their patients (Prentice and Stacey, 2001). Therefore, appropriate training or education must be provided to ensure that staff understand the principles of pressure ulcer prevention and management (NICE, 2001). Education must occur on a regular basis in order to maintain knowledge of current practices and equipment. This should include information about human and material resources available at specific institutions (Prentice and Stacey, 2001). All members of a multidisciplinary team have responsibility to provide care which prevents pressure ulcer development.

Education of patient/ carers/ family

It is essential that the patient with SCI/ carer/ significant others recognise the importance of skin care and their responsibility for the overall success of pressure ulcer prevention initiatives (Frost, 1999). Therefore, they require education regarding the ongoing management of skin. A successful educational initiative will highlight the importance of skin care and motivate an individual to take responsibility for their own care (McDonald, 2001).

Pressure ulcer prevention strategies are relatively complex, requiring significant life changes (Caliri, 2005). Patients with SCI need a clear understanding of what their prevention regimen involves, and at least a basic understanding of why the specific aspects have been recommended. The education plan should include both short and long term objectives for the patient (McDonald, 2001). Adherence to preventable regimens is of utmost importance to avoid pressure ulcer development. It has been found that individuals often do not understand or retain health behaviour instructions the first time they are given them. For this reason it is important that educational initiatives are ongoing, and embrace secondary techniques such as visual aids and pamphlets. Repeated practice of skills such as weight shifts and skin inspections will often lead to greater adherence (McDonald, 2001).

A range of factors such as social support, financial support, psychological distress, cognitive impairment, and substance abuse have all been found to compromise adherence to preventative regimens. (Caliri, 2005). Motivation is another key element for continuing adherence to a skin management program.

Motivation to comply may depend on a patient's belief about their own susceptibility to the development of a pressure ulcer (Garber et al, 2002). Unfortunately most males with SCI have been found to be under the false belief that they are unlikely to develop a pressure ulcer (Garber et al, 2000). Pressure ulcers often necessitate bed rest and are

perceived as a step back in rehabilitation due to the associated lack of independence. This in itself can often be a motivation to effectively care for the skin (Gibson, 2002) (Langemo et al, 2000).

After consideration of all of these factors, educational content should include information on risk factors, sites that are at greatest risk for them, how to inspect the skin and recognise changes, how to care for the skin, methods of pressure relief, the importance of seeking professional advice if a pressure ulcer is found, and appropriate professional contacts (NSW Health 2003b; NICE, 2001).

If a patient is unable to carry out their own skin care, education initiatives should be directed toward the post-discharge caregivers (Frost, 1999). Carers must be taught safe repositioning techniques, not only for correct anatomical positioning of the patient, but also to prevent self back injuries from incorrect lifting/ turning techniques. (Prentice and Stacey, 2001).

Seeking advice (Table 2)

It is recommended that patients with SCI form links with local health care professionals to manage the ongoing health related problems. It is expected that the local health care professionals are able to keep abreast of SCI related education and access the resources available to them for the best skin management outcome.

The acute and rehabilitation SCI Units can support local health care providers with current best management recommendations and advice for skin management and pressure ulcer prevention.

The SSCIS also provides preventative skin management and pressure ulcer prevention through a statewide seating service (see Appendix 7 for contact details).

Reasons for seating referral may include:

1. A history of pressure issues or a current pressure ulcer
   - Where resolution may require substantial ongoing local therapy and or nursing support
   - Which is complex and/ or non-healing and felt to be related to seating (typically wheelchair, cushions, commodes or vehicle seating arrangements)
   - Which is recurrent
   - Which are unrelated to seating, but felt to be compromised by seating protocols
   - Post plastic surgery

2. Posture issues, where seating expertise in general is required
   - e.g. scoliosis, kyphosis, obliquity, instability, pain

3. Wheelchair/ mobility issues where:
   - Clients fall or are at risk of falls from the chair
   - Clients have problems operating or controlling the chair, or safety issues arise
   - Seating or mobility equipment requires replacement
   - Ventilation equipment will need to be attached to a wheelchair

4. Past clients with complex problems are best managed through consultation with seating services.

(NSWSSCIS, 2005b)

Module 8, part 3:

Waterlow Scale

Build / Weight for Height		Mobility		Special Risks	
Average	1	Fully	0	Tissue Malnutrition	8
Above Average	2	Restless/Fidgety	1	E.g. Terminal cachexia	
Obese	3	Apathetic	2	Multiple organ failure	8
Below Average	4	Restricted	3	Single Organ Failure E.g. Cardiac Failure	5
		Inert/Traction	4	Peripheral Vascular Disease	5
		Chairbound E.g. wheelchair	5	Anaemia	2
				Smoking	1
Continence		Sex / Age		Neurological Deficit	
Complete / Catheterised	0	Male	1	E.g. Diabetes, MS, CVA Motor/Sensory, Paraplegic	4-6
Occasional	1	Female	2		
Cath/Incontinence of Faces	2	14-49	1		
Doubly Incontinent	3	50-64	2		
		65-74	3		
		75-80	4		
		80 +	5		
Skin Type Visual Risk Areas		Appetite		Major Surgery / Trauma	
Healthy	0	Average	0	Orthopaedic – below waist, spinal	5
Tissue Paper	1	Poor	1	On table - > 2 hours	5
Dry	1	NG Tube / Fluids Only	2		
Oedematous	1	NBM / Anorexic	3		
Clammy (temp)	1				
Discoloured	2				
Broken / Spot	3				
				Medications	
				Steroids, Cytotoxic, High Dose Anti Inflammatories	4

SCORE	10 + AT RISK	15+ High Risk	20 + Very High Risk

N.B. SEVERAL SCORES PER CATEGORY CAN BE USED: ADD TOTAL

Excerpts from Skin Care and Pressure Area Prevention in patients with Spinal Cord Injury ©, Consensus Document, April 2008, for Spinal Seating Professional Development Program, Module 8
http://www.health.nsw.gov.au/gmct/spinal/sspdp/ssm/Module_08/part_1.html

Module 8, part 3:

Neurological changes due to SCI

Depending upon the severity of the injury and the resultant damage to the spinal cord some or all of the following may be present:

- Total or partial loss of motor function below the level of the lesion
- Total or partial loss of sensory function below the level of the lesion
- Alteration in temperature control
- Alteration to blood pressure and circulation
- Autonomic disturbance
- Altered bladder and bowel function
- Altered sexual function
- Altered fertility in male patients with SCI

ASIA scale and level of injury: The American Spinal Injury Association (ASIA) developed a standard system for the neurological classification of SCI. This involves measuring motor and sensory function in order to determine the neurological level and completeness of injury. A SCI at any level places patients at high risk of skin breakdown. Varying levels of injury place unique risks on the patient (ASIA, 2002).

To determine the extent of the injury, it is necessary for a complete neurological assessment to be performed and the level and severity of the injury graded according to the American ASIA Scale. It is recommended that ASIA scores are repeated at various times after spinal cord injury as they can change as the individual's neurological status can improve or deteriorate.

Listed below are explanations of a range of neurological changes due to SCI, and their associated effects on the skin and skin management.

Motor: The degree of intact motor function following SCI is determined by the level and completeness of the injury - this is measured and classified using the ASIA scale. For example, a complete transection at the C1-C3 level results in the most severe motor function loss and will render the patient ventilator dependent. Progressively lower injuries allow for greater degree of intact motor function and therefore less severe functional outcomes. (Tortora and Derrickson, 2006).
(Level of Evidence – V)

Sensory: A large range of sensations are felt through the skin, including tactile sensations (touch, pressure, and vibration), thermal sensations (warmth and coolness), and also pain. Pain is usually an indicator of impending or actual tissue damage. The retention of sensation is similar to that of motor function, and is related to the level and completeness of injury (Tortora and Derrickson, 2006). A spinal injured patient's potential loss of pain sensation is of great concern as skin and tissue damage below the level of injury may not be felt. It is often the subconscious discomfort that prompts a non spinal cord injured individual to reposition themselves and therefore prevent tissue damage (WCANSW, 2002; Fries, 2005; Salcido, 2005).
(Level of Evidence – V)

Vascular: Individuals with an SCI have reduced blood flow below the level of injury, as well as a reduced blood supply. This results in a reduction of nutrients to the skin and surrounding tissue. A reduction of oxygen supply increases the possibility of ischemia which may lead to tissue damage and pressure ulcers (Rubayi, 2003). (CSCM, 2000).

Normal vascular responses are essential to maintain blood pressure. When a person stands up, blood vessels in the abdomen and the legs normally constrict to prevent blood from pooling. This response does not occur in people with SCI, potentially causing their blood pressure to drop sharply when they sit up. This can result in significant episodes of syncope in the early post injury phase and negatively impact on rehabilitation progress. Although vascular responses may recover over time, it is likely that assisting interventions such as TED stocking and abdominal binders may be required (Hagen, 2005), (Zejdlik, 1992)
(Level of Evidence – V)

Biochemical factors: As mentioned previously in this document, oxygen delivery is reduced below the level of injury in a spinal patient. In relation to this, it has been reported that normally innervated skin can withstand ischemia three hours longer than neurologically impaired skin. Reduced blood flow and nutrient supply can also have adverse effects on wound healing. Below the level of injury there is also a degradation of collagen which affects the integrity of the skin. This results in a much thinner, weaker skin below the level of the injury (CSCM, 2000).
(Level of Evidence – V)

Respiratory: Obstructions to the airway are commonly associated with cervical spine injury. Depending on the level of injury, a patient may also have difficulty with the abdominal contractions required to produce a forceful cough. This can be potentially fatal due to choking on secretions or foreign objects (Zejdlik, 1992). Spinal cord injuries with a resultant injury at or above C3 ASIA A or B will require permanent ventilatory support.

Below the C4 level, regardless of the ASIA score, there is usually sufficient respiratory function. However vital capacity is typically reduced due to muscle denervation particularly in the accessory and diaphragm muscles. This has an impact on the level of oxygen in the blood, and hence the level of oxygen available for cellular exchange (Zejdlik, 1992; Vernon, 2003).
(Level of Evidence – V)

Sleep disorders: Although there are few available studies, research suggests that spinal injured patients have high rates of sleep disorders. Sleep may be disrupted by the injury itself, or by the consequences and treatments of the injury. Treatments that may interrupt sleep include repositioning to prevent pressure ulcers and bladder and bowel management (Vernon, 2003).

Individuals with SCI have an extremely high prevalence of sleep apnoea, with reported incidences of 55% in male tetraplegic patients (Stockhammer et al., 2002). Sleep apnoea is defined as the cessation of breathing during sleep. Although minimal spinal specific evidence exists, continuous positive airway pressure is considered to be the therapy of choice for this disorder (Burns et al, 2005).
(Level of Evidence – IV, V)

Spinal shock: Spinal shock is the sudden and transient physiological reflex depression of spinal cord function below the level of acute spinal injury with associated loss of all sensorimotor functions. This is associated with an initial increase in blood pressure due to the release of catecholamines, followed by hypotension. Flaccid paralysis, including of the bowel and bladder will occur, and sometimes sustained priapism develops. Depending on which particular reflex is assessed the duration of spinal shock can vary, although it is widely accepted that recovery from spinal shock and the return of most reflexes occurs within a few days to a few weeks (Dawodu, 2005).
(Level of Evidence – V)

Neurogenic shock: Occurs in injuries above the level of T6, secondary to the disruption of the sympathetic outflow, and to unopposed vagal tone. Neurogenic shock is

characterised by a triad of hypotension, bradycardia, and hypothermia. This leads to a decrease in vascular resistance with associated vascular dilatation, and the sympathetic nervous system blocked. The parasympathetic nervous system is unchallenged. This results in extreme vasodilatation, decreased venous return, decreased cardiac output, and decreased tissue perfusion (Dawodu, 2005).
(Level of Evidence – V)

Autonomic function / dysfunction*:* The function of internal organs and muscles is threatened when communications between the autonomic and central nervous systems are lost as a result of SCI. This can have negative effects on the stability of the internal environment in the injured patient (Zejdlik, 1992). Autonomic dysfunction in the acute phase can have major effects on the cardiovascular system, respiratory system, and temperature regulation. The extent of these effects can be potentially life threatening. Additionally, autonomic nervous system dysfunction effects bladder and bowel control, sexual function and fertility viability in men (Karlsson, 2006; Peerless et al, 1999).
(Level of Evidence – V)

Autonomic dysreflexia*:* Patients with an injury at or above T6 are at risk of this condition. It can be caused by any stimuli below the level of injury (which if sensate may or may not be painful), creating an exaggerated response of the sympathetic nervous system. The most common stimuli is an over distended bladder, however pressure sores can also cause this undesirable response. The sympathetic nervous system's response of most concern is the potentially life-threatening elevation in blood pressure (Vernon, 2003; McKinley et al, 1999). Removal or control of stimuli is important to prevent fatal complications such as cerebral haemorrhage (Zejdlik, 1992b).
(Level of Evidence – V)

Cardiovascular*:* Spinal cord lesions result in impairment of autonomic pathways which alter cardiovascular function. Patients with high paraplegia or tetraplegia are at the greatest risk for cardiovascular disturbance. Usually cardiovascular function will stabilise, however low blood pressure and pulse rate may persist. This is associated with cardiovascular concerns such as, autonomic dysreflexia, deep vein thrombosis, and long-term risk for coronary heart disease. Additionally, when circulation slows, blood pools in the abdomen and lower limbs. There is an increase in primary cardiac problems in SCI patients older than 55 years (Zejdlik, 1992b; Vernon, 2003; Schreiber, 2005).
(Level of Evidence – V)

Thermoregulation*:* In a patient with a SCI the hypothalamus is unable to receive much of the input sensation from the skin receptors and the spinal cord. Some of the mechanisms to maintain or alter core body temperature are lost, such as the ability to sweat to cool the body, and shivering to warm the body. As a result, patients with SCI are less able to adjust in accordance to external temperature changes (Vernon, 2003).

Due to the above factors patients with SCI are very prone to poikilothermia, which is characterised by an inability to maintain a steady internal body temperature and thereby assume the temperature of the external environment. Below the level of injury, patients with SCI may experience acute or chronic loss of vasomotor tone and passive vasodilatation, causing a continuous loss of body heat resulting in hypothermia (Zejdlik, 1992).
(Level of Evidence – V)

Gastro Intestinal System*:* Following a SCI, patients have a reduction in their energy needs, which remains throughout life. SCI only temporarily affects the digestive system, with the exception of the distal colon and the rectum.

It has been found that individuals with SCI have lower daily energy expenditure in comparison to uninjured controls. This was related to a number of factors including

reduced spontaneous physical activity, basal metabolic rate, fat-free mass, and the thermic effect of food (Monroe et al, 1998).
(Level of Evidence – III)

Bowel and bladder dysfunction*:* Completeness of injury is a major predictor of continence. Patients with incomplete injuries are likely to maintain some volitional bowel and bladder function (Vernon, 2003). Bladder control has both a voluntary and involuntary component and the level of injury affects the type and degree of dysfunction. There is a similar situation with bowel function, where an upper motor neuron lesion results in spastic bowel function, where as a lower motor neuron lesion results in flaccid bowel function (Zejdlik, 1992; Peerless et al, 1999).
(Level of Evidence – V)

Spasticity*:* Problematic spasticity is a major concern, affecting 40-60% of patients with a SCI. Spasticity can occur at any time following the resolution of spinal shock and the return of reflex activity. Although this can be beneficial by assisting transfers, functional mobility and maintaining muscle tone, uncontrolled spasticity and associated muscle spasm can be violent resulting in complications such as fractures, dislocations, and skin ulceration (Vernon, 2003).

Clinicians must acknowledge the potential for spasticity to contribute to pressure ulcer development and provide clinical interventions to reduce such risk. The cause of spasticity must be investigated, in order to address underlying reversible causes such as syrinxes. (Atiyeh and Hayek, 2005).

Spasticity and associated muscle spasm can potentially interfere with a patient's ability to successfully participate in activities of daily living. Muscles spasms can make weight shifting and skin inspection difficult. Additionally, correct limb positioning (to avoid pressure post plastic surgery intervention), in particular on a suture line, can be difficult, if not impossible (Atiyeh and Hayek, 2005). Furthermore, a developing pressure ulcer can increase spasticity (Cardenas et al, 2004).
(Level of Evidence – IV, V)

Contractures*:* Following SCI, muscles, tendons, and ligaments may shorten, which is known as a contracture. This results in reduced joint movement, and in the most severe cases the joint can become fixed. This can be problematic in areas where opposing skin surfaces touch and may rub (such as skin folds), as maceration and superficial fungal infection can lead directly to skin ulceration. Furthermore, contractures may limit repositioning options, posing difficulty during pressure relief and transfers (Zejdlik, 1992).
(Level of Evidence – V)

Other health conditions which may impact on skin management

The patient's existing/ pre-existing health conditions must be taken into account as these factors can lead to skin breakdown, but in combination with SCI they will pose additional risk. Examples give below are frequently seen in association with SCI, but are not intended to be an exhaustive list.

Associated fractures*:* With associated fractures, the mobility limitations on a patient with SCI may be increased. Fractures that occur at the time of injury (or otherwise) have the potential to reduce patient's mobility, transfer ability, and ability to perform appropriate skin care.
(Committee consensus)

Traumatic brain injury*:* The importance of educating patients who have recently

sustained a SCI will be emphasised throughout this document. The number of new tasks and skills a patient is required to learn will at times be daunting and may be exacerbated due to cognitive limitations associated with brain injury. An inability to learn may have adverse effects on self-care, skill acquisition, and associated independence and rehabilitation. A brain injury will often compound many of the negative consequences of a SCI. Brain injury may be related to SCI because the severity of the physical impact causing the spinal injury often has the potential to cause a brain injury (Vernon, 2003). Associated head injuries (e.g. amnesia, skull fracture, focal neurological deficits) are common, occurring in approximately 25% of patients with SCI (Schreiber, 2005).
(Level of Evidence – V)

Depression, anxiety, and other psychological disorders*:* Symptoms of clinical depression are commonly associated with SCI. High rates of depression are of concern due to associated secondary complications such as inadequate nutritional intake, poor concentration, and motivation (Krause et al, 2000). Low self esteem and life satisfaction have also been found to be associated with pressure ulcer development (Krause et al, 2001)

Anxiety disorders may result in a number of counter-productive events, including inability to cooperate with care providers, inactivity and self neglect.
(Level of Evidence – IV)

Diabetes*:* The long-term effects of diabetes can contribute to the development of a pressure ulcer and also act as a hindrance to their healing. Diabetes results in diminished sensation and reduced arterial flow which of great concern. Acute loss of diabetic control can result in impaired cardiac output, poor peripheral perfusion, and impaired polymorphonuclear leukocyte phagocytosis (Stillman, 2002).
(Level of Evidence – V)

Anaemia*:* Anaemia, which indicates poor oxygen carrying capacity of the blood, can contribute to tissue vulnerability to breakdown, and delay healing of an existing wound (Revis, 2006; Salcido, 2005).
(Level of Evidence – V)

Other factors which may impact on skin management

Metabolic changes (endocrine/ cardiac)*:* A number of changes occur to the skin after SCI, some of which may take several years to stabilise. These changes are mainly related to the catabolism and biosynthesis of collagen resulting in production of weaker collagen fibrils which promotes fragile and less elastic skin below the level of the SCI lesion (CSCM, 2000)(Level of Evidence – V)

Ageing*:* Changes associated with ageing that have the greatest effect on skin include;

- musculoskeletal changes and deterioration of muscular strength (Vernon, 2003; Greenaway, 2003)
- skin structure changes such as thinning, reduced elastin, reduced collagen fibres, and decreased moisture (Ratliff and Rodeheaver, 1999; Greenaway, 2003)
- cognitive changes
- older people have significantly lower levels of independence in the area of skin care, in comparison to younger adults (Kennedy et al, 2003).
- higher rates of incontinence (Kennedy et al, 2003)
- mobility needs are higher in older SCI patients, including reduced ability to perform appropriate transfers (Greenaway, 2003; Kennedy et al, 2003)
- increased frequency of co-morbidities (Krassioukov et al, 2003)

These changes in combination with SCI, place the elderly population at a uniquely

elevated risk for skin breakdown, and thus require specific consideration in prevention and management of skin breakdown (NSW Health, 2004; Krause et al, 2001; Chen et al, 2005; Fourney et al, 2002).
(Level of Evidence – IV, V)

Immobility*:* Any person who is unable to reposition themselves is at increased risk of developing a pressure ulcer. An inability to reposition oneself will potentially cause unrelieved pressure, preventing oxygenated blood from reaching the tissue (WCANSW, 2002).
(Level of Evidence – V)

Alcohol and Substance use*:* Substance use has been found to be associated with an increased risk of pressure ulcer development. Those most likely to be at-risk drinkers and substance users tended to be younger, single, less educated males (Tate et al, 2004).
(Level of Evidence – IV)

Activity*:* Too little activity can place an individual at increase risk of skin breakdown due to a lack of pressure relief and repositioning. Such a lack of activity may lead to increases in weight causing equipment to becoming inappropriate and/ or ill fitting. Conversely, excessive/ risk taking activity may lead to skin insult or the neglect of preventive skin care techniques.
(Committee consensus)

Social Factors*:* Individual social factors may affect ones' ability to successfully adhere to skin care regimens. These include ineffective social support, employment status, marital status, and flexibility of employment arrangements (Greenaway, 2003; Krause et al, 2001; Wellard, 2001; Chen et al, 2005).
(Level of Evidence – IV, V)

Smoking*:* Smoking has an immediate effect on tissue oxygenation, and a long term effect on arterial oxygen tension. Therefore, smoking makes the soft tissues more susceptible to ischaemia thus contributing to pressure ulcer development and adversely effecting wound healing (Vernon, 2003; Greenaway, 2003; WCANSW, 2002; Krause et al, 2001; Frost, 1999; Krause and Broderick, 2004; Revis, 2006).
(Level of Evidence – IV, V)

Surgery*:* Patients undergoing surgery have been found to be at increased risk of pressure ulcer development. The underlying risk factor is that patients are often immobile due to sedation and anaesthesia and are unable to their change position. A range of additional risk factors have been identified including older age, lower weight, lower BMI, food intake/ nutritional status, and lower serum albumin levels and support the use of pressure risk assessment tools. (Lindgren et al, 2005). A pressure ulcer risk assessment tool (The Risk Assessment Pressure Sore Scale) was used to determine each patient's risk prior to surgery, which proved to have a strong predictive value for pressure ulcer development during surgery. This highlights the importance of identifying patients at risk preoperatively in order to initiate preventative measures. A major limitation of this study is the fact that it was not a SCI specific population group; however the principle of immobilisation during surgery remains the same for all patients.

In addition, an assessment should also occur post-operatively, or if there is a clinical change in a patient's condition (WCANSW, 2000).
(Level of Evidence – IV, V)

Skin trauma*:* There are a range of external sources of skin trauma which can contribute to the development of skin breakdown and/ or pressure ulcer development. Some may be obvious, where as others are relatively unique considerations for the spinal cord injured population. Listed below are a range of examples of skin trauma:

***Heat**:* External sources of heat can cause burns. Burns can result from the sun, hot showers, or hot food/ drink. Burned skin is extremely fragile making it more susceptible to breakdown. Additionally, too much heat on the skin can increase the metabolic rate, increasing oxygen consumption, which makes it less tolerant of ischemia (McDonald, 2001).

***Equipment**:* Skin that comes in contact with any equipment such as bed frames, chair frames, tubes, and monitors must be assessed at least daily (Peerless et al, 1999).

***Accidental bruising**:* Bruised tissue needs to recover before it can tolerate pressure at the level it was capable previously.

***Pressure**:* The force per unit area exerted perpendicular to the plane of interest (NPUAP, 2006)

***Friction*:** Defined as the resistance to motion in a parallel direction relative to the common boundary of two surfaces (NPUAP, 2006). Examples of this include the rubbing between sling fabric and the skin and sliding self-transfers on cotton sheets or other high friction surfaces.

***Shear (shear stress)**:* The force per unit area exerted parallel to the plane of interest (NPUAP, 2006)

***Shear strain**:* Distortion or deformation of tissue as a result of shear stress (NPUAP, 2006)

Shearing under the pelvis is increased in a wheelchair with a reclined backrest and a seat that is flat (parallel with the floor). Wheelchairs with backrest recline should also have a seat tilt (seat recline) capability, and the seat and backrest should be reclined together.

Any condition that requires the patient to elevate the head of the bed to a level greater than 30 degrees places them at increased risk due to the pressure, shear, and friction associated with such a position (Ratliff and Rodeheaver, 1999; Peerless et al, 1999). The backrest should be raised only if knee break is also used.

Poor care and/ or poor technique during transfers can result in accidental skin trauma. It is important that all transfers are performed correctly with adequate clearance from the surface and control in execution. This includes transfers into chairs, commodes, and cars.

Surgical wounds, grazes, and lacerations all affect the dermal layer of the skin, making it susceptible to further breakdown if pressure is applied.
(Level of Evidence – V)

***Nutrition**:* Nutritional status does influence the integrity of the skin and support structures, and a lack of micronutrients may predispose the patient to increased risk of pressure damage (Lindgren et al, 2005; Cullum and Clark, 1992; Banks, 1998; Casey, 1998b; Casey, 1998a; Vernon, 2003; Bergstrom et al, 2005). Emaciated and obese people have also been associated with being at higher risk (Allman et al, 1995; Gallagher, 1997; Pope, 1999a; Pope, 1999b; Mastrogiovanni et al, 2003). The poor nutritional status of a person with a pressure ulcer may be more a marker of poor overall health status than as a result of poor nutritional intake (Finucane, 1995). Also dehydration may reduce the elasticity of tissues and thus increase tissue deformability under pressure or friction.

***Weight**:* Obese or bariatric patients are at no lesser risk of pressure ulcer development in comparison to those with normal weight. Some practitioners believe that the excess

body fat provides padding, and thus reduced pressure ulcer risk; however this is not supported by scientific evidence. Obese or bariatric patients may actually be at greater risk of pressure ulcers due to less protein stores and lean tissue bulk. Practical problems may also arise such as the availability and affordability of appropriately sized equipment (chairs, beds, commodes), and the ability to perform independent weight shifts. The increased number of skin folds may also make it difficult to keep skin clean and dry (Mastrogiovanni et al, 2003).

Conversely, underweight patients may also be at great risk of pressure ulcer development. Underweight patients have more bony prominences which potentially increases the risk of pressure ulcer development (Krause et al, 2001).
(Level of Evidence – IV, V)

***Bed rest**:* Prolonged bed rest due to medical condition or prescribed management, increases the risk of pressure ulcer development on the sacrum, greater trochanter, and the heels (Wilhelmi and Neumeiser, 2002).

Initial treatment for all pressure ulcers involves complete removal of all pressure on the affected area. Depending on the site of the pressure ulcer, this will often require complete bed rest. If 24 hour bed rest is indicated, the patient with SCI will be at a significantly increased risk for further skin breakdown on other areas unless a suitable mattress is used and pressure management guidelines are implemented, including vigilant observation and turning.
(Level of Evidence – V)

***Previous pressure ulcer**:* History of a previous pressure ulcer has been identified as a risk factor for future skin breakdown (Charlifue et al, 2004). Potential recurrence of pressure ulcers is a problem since scar tissue has significantly reduced tensile strength and other cellular level changes which make it more prone to tissue damage (NICE, 2001).

In order to heal an existing pressure ulcer, patients will often be subject to prolonged immobilisation and limited repositioning options. This will place them at increased risk of further skin breakdown. As these patients have already developed a pressure ulcer, they may have a range of other risk factors further elevating their risk.
(Level of Evidence – IV, V)

***Moisture**:* Although urine, faeces, and sweat impact the skin in different ways, they are all external sources of moisture that can potentially damage the skin and lead to breakdown. Faecal incontinence is a concern as the bacteria and enzymes in the stool are caustic to the skin. Conversely, skin that is excessively dry is also susceptible to damage (EPUAP, 1998; Ratliff and Rodeheaver, 1999; Revis, 2006; Thomas, 2006; McDonald, 2001; Vernon, 2003; Stillman, 2002; WCANSW, 2002; NSW Health, 2004; Fourney et al, 2002).

Additionally, friction and shearing forces are enhanced in the presence of moisture (WCANSW, 2000; Ratliff and Rodeheaver, 1999; Revis, 2006; Salcido, 2005).

It is important that patients with SCI bathe regularly/ receive regular bathing, in order to meet their daily hygiene needs. Appropriate moisturising creams should also be used eg. Sorbalene (Greenaway, 2003).
(Level of Evidence – V)

***Fungal infections**:* Untreated fungal infection contributes to reduced skin integrity and skin breakdown. This is most commonly seen as a local fungal infection below the level of injury. It is important to obtain early diagnosis and provide adequate treatment (Rubin-Asher et al, 2005).

(Level of Evidence – IV)

***Medications**:* Medications potentially alter a range of motor, sensory, and neurologic aspects of the patient. These changes may place the patient at increased risk of skin breakdown. High risk examples include people presenting with severe pain requiring strong analgesia, with concomitant substance abuse (alcohol, opiates, barbiturates) and people requiring vasoconstrictive agents such as ionotropes (NSW Health, 2003b; Krause and Broderick, 2004; Peerless et al, 1999).
(Level of Evidence – V)

***Time Since Injury**:* Garber et al, (2000) found time since injury to be associated with the prevalence of pressure ulcers. Chen et al,(2005) reported similar findings, with a particular increase in pressure ulcer risk 15 years post injury.
(Level of Evidence – III)

***Provision of care**:* It is essential that patients have access to appropriate care in accordance to their level of need. Those providing care must have adequate skills and knowledge in regards to SCI and skin management. Furthermore, the patient must adhere to health care practices prescribed by health professionals in regards to skin care and management.
(Committee consensus)
The neurological level of injury and a range of other factors will affect a patient with SCI's required level of attendant care support (MAANSW, 2002).

***Surgical / medical procedures**:* Admission to hospital at any time poses increased risks of skin breakdown as the admission is often associated with prolonged immobilisation. Bed rest may lead to a loss of strength through deconditioning, and potentially postural asymmetry if the majority of time was spent on one side. Surgical procedures such as the Girdlestone procedure, and hip disarticulation significantly reduce weight-bearing area when sitting, thereby increase loading and seating pressures. During surgical and medical procedures, it is essential that staff have the skills and knowledge to prevent skin breakdown. This is of utmost importance, as patients will often have an altered level of consciousness and may be unable to direct their own care.
(Committee consensus)

***Resource access**:* A patient's geographical location may make it impractical to visit a health care facility in order to receive appropriate care. Appropriate prevention and management plans may be financially unviable, in regards to equipment as well as professional care/ skin care advice (Tiger, 2003).
(Level of Evidence – V)

***Suitability of physical environment**:* Inadequate accommodation may place limitations on one's ability to practice appropriate care. For example, housing may be inappropriate or admission to an intensive care unit may be extensive (Tiger, 2003).
(Level of Evidence – V)

***Level of independence / self care**:* It is essential that patients and/ or carers have sufficient and up to date knowledge in regards to skin care and management. Any limitation on the patient's ability to practice self-care places increased demands on the carer. This potentially places the patient at greater risk of skin breakdown, as they must rely on a carer to manage their skin. Time constraints on patients may also limit their ability to manage their own skin. Such time constraints may arise from a busy work life or parental role.
(Committee consensus)

***Pregnancy and confinement**:* Pregnancy increases the risk of pressure ulcer

development primarily due to weight gain and/ or postural changes. The increased size and weight of the patient may cause current equipment to become inappropriate due to size or weight limits (e.g. mattresses/ cushions). Transfers and pressure relieving strategies may become more difficult. The uneven distribution of weight in a pregnant patient must be considered with regards to pressures when seated and when in bed. Hospitalisation during the final stages of pregnancy is potentially problematic, particularly due to prolonged immobilisation and bed rest (SCIIN, 2003).
(Level of Evidence – V)

Module 8, part 4:

Aetiology of a pressure ulcer

A pressure ulcer is described as a lesion caused by unrelieved pressure, friction or shear. Pressure usually occurs when soft tissue is compressed against a bony prominence (WCANSW, 2000; Salcido, 2005). It is important to remember that the surface causing compression may not appear to cause significant pressure, for example a regular mattress. Pressure ulcers develop commonly on the sacrum, greater trochanter, ischial tuberosity, and heels but can develop anywhere on the body including the coccyx, occiput, clavicle, ear, and nose.

Building on this definition, compression of blood vessels that feed soft tissues can potentially decrease or completely obstruct blood flow, causing a local ischemia. Prolonged ischemia will cause a local area of necrosis, and a surrounding area that is ischemic. By definition, this is a “pressure ulcer”. The time for necrosis to develop is related to the ability of the tissue to resist ischemia, which differs in all individuals (Dunford, 1998). Tissue tolerance is defined as the ability of the skin to redistribute the applied pressure (Thomason, 2001).

It has been demonstrated that the capillary closing pressure on the arterial side is around 30-32mmhg (Salcido and Goldman, 2000) and around 12mmhg on the venous side (Peerless et al., 1999). Sustained pressure at values higher than these may result in circulatory compromise and tissue necrosis.

Shearing forces also have the ability to interfere with blood flow to soft tissue. This occurs due to the lateral force produced on the soft tissue, that can readily cause kinking in the capillary loops (Vernon, 2003; Ratliff and Rodeheaver, 1999).

Efforts to prevent pressure ulcers are often based around minimising the degree and duration of tissue compression (Vernon, 2003). Unrelieved pressure initially causes damage in deeper tissue before any visible breakdown is seen in the in the epidermis (CSCM, 2000). This is due to the fact that pressures can be 3-5 times greater close to a bony prominence as opposed to on the skin's surface (Russ and Motta, 1991).

Muscle and fat are the tissues at greatest risk of necrosis when they are deprived of oxygen. For this reason, initially the true depth of damage due to pressure may be unrecognisable if the skin remains relatively intact. Therefore, skin discoloration or redness may actually be an indicator of underlying adipose or muscular necrosis. This often creates the illusion that a pressure ulcer is worsening as the true extent of the damage becomes visible. Research indicates that deep damage to muscle and/ bone happens relatively quickly when a person is unable to move (WCANSW, 2002; Ratliff and Rodeheaver, 1999)

Friction most often occurs as a result of poor lifting and transfer techniques (EPUAP, 1998). Friction causes a mechanical force that can remove the top layers of skin, increasing pressure ulcer risk (NICE, 2001; Ratliff and Rodeheaver, 1999). Shearing is the force exerted parallel to the plane of interest, which can cause the distortion or deformation of tissue (Fig. 12)
(NPUAP, 2006).

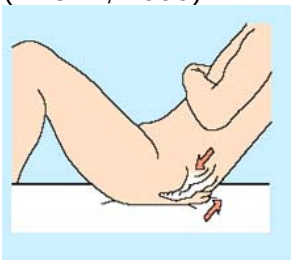
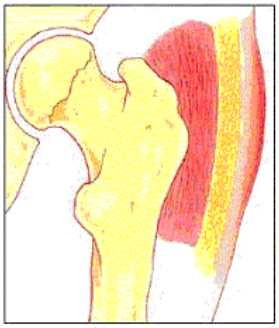


Fig.12 Action of shearing and friction forces on the skin

Module 8, part 4:

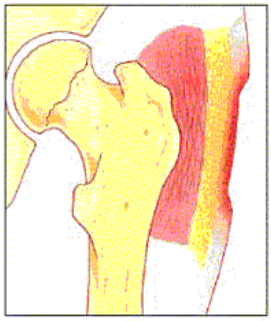
Staging of pressure ulcers

The stages of pressure ulcers are defined as follows:



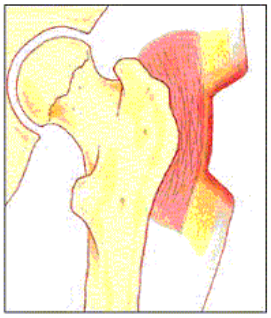
Stage 1

Stage 1
Observable pressure-related alteration of intact skin whose indicators as compared to an adjacent or opposite area on the body may include changes in one or more of the following: skin temperature (warmth or coolness), tissue consistency (firm or boggy feel), and/ or sensation (pain, itching).
The pressure ulcer appears as a defined area of persistent redness (non blanching erythema) in lightly pigmented skin, whereas in darker skin tones, the pressure ulcer may appear with persistent red, blue, or purple hues.



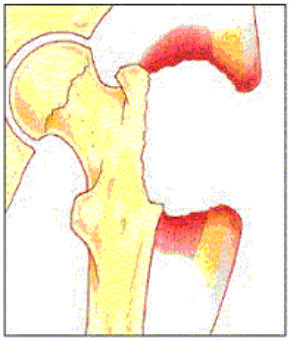
Stage 2

Stage 2
Partial thickness skin loss involving epidermis, dermis, or both. The pressure ulcer is superficial and presents clinically as an abrasion, blister, or shallow crater.



Stage 3

Stage 3
Full thickness skin loss involving damage to, or necrosis of, subcutaneous tissue that may extend down to, but not through, underlying fascia. The pressure ulcer presents clinically as a deep crater with or without undermining of adjacent tissue.



Stage 4

Stage 4
Full thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures (e.g., tendon, joint, capsule). Undermining and sinus tracts also may be associated with Stage IV pressure ulcers.

Pictures used with permission from AWMA (2000)

Module 8, part 4:

Risk factors for skin breakdown common to all phases of care

Risk factors are present for all phases of a SCI, applicable across the continuum of care. Different phases of care present unique risk factors which need to be considered specifically.

The relative importance of these risk factors cannot be determined without an individualised assessment. Therefore **all** risks should be considered when planning patient care. The risk factors below have not been listed in any order of priority.

Spinal Cord Injury
Motor and sensory deficits
ASIA A, B, C Score
Level of injury
Time since injury
Spasticity and spasm secondary to SCI
Posture
Contractures
Compromised blood supply

History of previous pressure ulcer
Or, presence of an existing pressure ulcer

Co-morbidities
Diabetes
Associated fractures
Traumatic brain injury
Associated head injury
Anaemia

Functional ability
Immobility is **the** most significant risk factor for pressure ulcer development
Physical impairments
Mobility

Provision of care
Care arrangements
Skill and knowledge of health care professionals and carers

Skin trauma
Pressure
Shearing
Friction
Burns
Surgical wounds
Graze
Lacerations
Bruises

Ageing
Musculoskeletal changes
Skin structure changes
Cognitive changes
Level of care and support

Autonomy in self care
Continence
Muscle mass
Mobility
Co-morbidities

Note: Patients under the age of 16 require paediatric-specific guidelines.
Due to the identified risk factors the elderly also require specific approaches.

Lifestyle
Substance use; prescribed and non-prescribed
Smoking
Activity
Social support
Employment status
Single
Flexibility of employment arrangement to allow for recovery

Cognitive function
Psychological distress
Mental health status
Non adherence to 'health behavioural' regime
Life satisfaction and self-esteem (Krause et al., 2001)

Equipment
Ill fitting equipment
Equipment in need of repair
Ineffective equipment
User inability to operate, maintain, or manage equipment
Continence appliances must be positioned correctly
Slide boards
Hoists and slings
Clothing; too tight, seams, pocket studs etc

Surgical/ medical procedures
Admission to hospital
Decreased knowledge of staff relation to skin management
Altered level of consciousness
Anaesthetic time during surgery
Loss of strength ("de-conditioning") following prolonged bed rest
Postural asymmetry following prolonged bed rest on one side
Prolonged immobility
Medications

Suitability of physical environment

Resource access
Inadequate local resources
Rural and remote locations
Financial concerns (appropriate prevention and management may be financially non-viable)

Nutritional status
Dietary intake
Hydration level
Vitamin C deficit
Extremes in weight

Lean body mass

External medical/ nursing/ and therapeutic devices
Intravenous lines
Cervical collars
Drains
Catheters
IDC/ SPC straps
IV caps left in bed
Any device left on bed/ chair capable of exerting pressure on the patient
VAC therapy tubing
Plasters and splints
Raising the head of the bed 30 degrees or more

Level of independence/ self care
Capacity to direct self care if required
Insufficient or out of date knowledge of patient and/ or carer
Difficulty with practicing self care
Lack of knowledge of self care and management techniques
Time constraints

Hygiene
Sweat
Moisture
Personal daily hygiene needs
Regular bathing, and appropriate use of moisturising creams

Continence
Both urine and faeces

Pregnancy and confinement
Increased weight during pregnancy
Uneven distribution of weight
Equipment temporarily unsuitable
Immobility during delivery
Vascular changes

Module 8, part 4:

Pressure ulcer risk intervention guide

Appendix 3

Risk level identified by assessment tool	Preventative Interventions
Low Risk	• Daily skin inspection, no other action required • Re-assess when there is a change in the patient's condition • Document in case notes/ care plan the patient's skin condition and interventions instigated • Patient/ carer education on basic prevention • Promote activity as clinical condition indicates.
At Risk	• All of the above, plus: • Individualised repositioning regime, 300 turns • Pain assessment • Protective padding between bony prominences • Avoid shear and friction damage by using correct manual handling equipment • Minimise exposure to moisture (incontinence use absorbent pads), use mild cleaning agents, moisturise skin, use protective barrier creams • Assessment of nutritional status – monitor oral intake, appetite, self-feeding ability, and unintentional weight loss • Refer to dietician if patient thought to be at nutritional risk • Select an appropriate support mattress overlay – Alphaxcell, Autoexcell, Viaclin, Eggcrate (for spinal patients) • Seated patient to shift weight every 15 minutes (sitting forward for 2 minutes to reduce pressure on the Ischial tuberosity), reposition hourly if patient is unable to do so.
High Risk	• All of the above, plus: • Alternating mattress replacement – consider for spinal patients Autoexcell, Biwave, Trinova, Cairwave, Nimbus • Use chair cushion if sitting out of bed • Interventions should be clearly documented by the primary orthopaedic/ neurosurgical medical team prior to implementing.
Very High Risk	• All of the above interventions - plus: • Large cell pressure relieving mattresses – consider for spinal patients Nimbus, Cairwave, Pegasus, Airwave • Interventions should be clearly documented by the primary orthopaedic/ neurosurgical medical team prior to implementing.

(From RNSH, revised 2005) modified

Module 8, part 4

Determining the cause of a pressure ulcer

Appendix 6

When a pressure ulcer is discovered it is important to identify and document the likely cause. This information is valuable as a guide to what must be done to aid healing, prevent recurrence and eliminate the cause.
Sometimes an apparent pressure ulcer is actually the result of a burn, graze or other cause, and this needs to be kept in mind when seeking the cause of injury.

The location of the pressure ulcer is the most obvious clue as to the cause, and the Table below shows likely cases in relation to the position of the pressure ulcer and the bony prominence involved.

Tissue which has been recently damaged by a bruise, graze or burn is much more vulnerable to applied pressure than would normally be the case. For example, a patient with a bruise is (until the bruising heals) very vulnerable to pressure ulcers when sitting on the bruised tissue. In this case causative factor was not a problem with the patient's pressure cushion, but the failure to recognise the bruise and stay off it until healed. In such a case the sudden onset of the pressure ulcer (no recent history of red marks or skin problems) gives a clue that there may have been a specific incident that was the underlying cause. While the pressure cushion should be reviewed, there is also a need for patient education and review of factors that may have contributed to the initial bruise (eg. transfer techniques).

The occurrence of a pressure ulcer following a series of lesser indications (red marks, or discoloured, scaly skin etc) over time suggests a consistent problem with equipment, clothing or care practice that needs to be addressed.

Table 19. Likely cause in relation to bony prominence / contact surface

Bony prominence	Typically due to contact with	Additional factors to be considered
Ischial Tuberosity	· Seat (or cushion) in wheelchair, commode, car etc. · Mattress or clinical table, when backrest is partly raised. · Thick or harsh trouser material, clothing seams or creases. · Non-stretch cover over pressure cushion. · Hard object (keys, coin etc) left on pressure care cushion	Tuberosity is likely cause of pressure ulcers in the gluteal fold (crease between top of thigh and buttock), particularly when the body tends to slide forwards in chair, or slide down the bed due to raised backrest Height of foot supports is related to loading of pelvis on cushion – raising foot supports increases pressure under pelvis Duration of unrelieved sitting needs to be considered, particularly for "high pressure" seating such as commodes Beds with backrest raise should also have knee break to minimise shear under pelvis
Greater	· Mattress or clinical table (side	Poor sitting posture.

Trochanter	lying -when area is on lateral aspect of trochanter) · Seat (cushion) in wheelchair, commode, car etc.	See also factors listed under Ischial Tuberosity
Sacrum / Natal cleft	· Mattress or clinical table (supine, or with backrest partly raised) · Seat or backrest in wheelchair, commode, car etc	Poor sitting posture Natal cleft is susceptible to tearing of skin during hoisting with sling - hoisting technique is important Beds with backrest raise should also have knee break to minimise shear under pelvis
Coccyx	· Seat (cushion) in wheelchair, commode, car etc · Mattress (supine lying, prominent coccyx) · Thick or harsh trouser material, clothing seams or creases, or non-stretch cushion cover over pressure care cushion	See also factors listed under Ischial Tuberosity
Legs, Heels, Ankles & Feet	· Foot supports in wheelchair, commode etc · Foot board in bed (plantar surface of foot) · Mattress or clinical table (ankles in side lying, heels when supine) · Footwear	Absence of footwear leaves the feet vulnerable to injury Injury may be a burn from contact with metal parts of chair frame, or household plumbing, under bench contact with stovetop, or floor of car above exhaust etc., particularly when patient prefers bare feet
Head	· Mattress or clinical table (supine lying) or pillow · Orthosis or cervical collar · Headrest of wheelchair etc	
Scapula	· Mattress or clinical table (supine lying) · Backrest of wheelchair, commode, car seat etc.	Protruding scapulae are at increased risk
Elbows	· Mattress or clinical table (supine lying) · Armrest of wheelchair, commode, car etc	
Hips (Iliac spines)	· Clinical table or Mattress (supine lying) · Orthotic jacket · Ribcage (severe scoliosis)	
Ribcage	· Backrest tubing of wheelchair, commode etc · Thoracic support of wheelchair, commode etc.	Scoliosis increases risk
Spinous processes	· Backrest of wheelchair, commode, car etc. · Mattress or clinical table (supine lying)	Kyphosis increases risk

Equipment factors relating to pressure ulcers

Wheelchairs, commodes and others seating

- Sharp edges, protruding screws etc can damage cushions, or create risk of injury.
- Commode seat may have torn vinyl or sealed plastic seams that are sharp or rough.
- Commode seats aperture may be wrong size or badly placed to accept ischial tuberosities.
- Protruding brake handles, clothing guards etc can could cause bruising or injuries during transfers.
- Self-repositioning may be impeded by equipment problems eg. tilt in space, leg rest and/ or backrest actuators not usable, or lack of suitable grip points for self-lifting.
- New or changed equipment is a risk unless carefully trialled before final selection.

Car use

- No pressure care cushion may be available when one is required.
- Position of lower limbs when in a car can lead to injury through contact with unpadded or hot surfaces.

Module 8, part 4:

SSCIS Return to Seating Protocol ©

Day	Date	Time	Position	Skin Check Results
Day 1		0730	Lie on flap/ healed area for 20 minutes	
		0750	Reposition off area	
Sponge in bed or shower on trolley only			** **Notify** OT to arrange equipment Assessment. ** **Refer** to seating therapist (if accessible) for pressure mapping appointment *OT should assess condition of commode seat and apply for new seat (if this has not already been applied for previously) prior to showering via commode (Day 7)	*
		1330	Lie on area for 20 minutes	
		1350	Reposition off area	
		1630	Lie on area for 20 minutes	
		1650	Reposition off area	
Day 2		0730	Lie on area for 30 minutes	
		0800	Reposition off area	
		1330	Lie on area for 30 minutes	
		1400	Reposition off area	
		1630	Lie on area for 30 minutes	
		1700	Reposition off area	
		2030	Lie on area for 30 minutes	
		2100	Reposition off area	
Day 3		0730	Sit patient to 30° for 30 minutes	
		0800	Level bed and reposition off area	
		1330	Sit patient to 30° for 30 minutes	
		1400	Level bed and reposition off area	
		1630	Sit patient to 30° for 30 minutes	
		1700	Level bed and reposition off area	
		2030	Sit patient to 30° for 30 minutes	
			Level bed and reposition off area	
Day 4		1030	Sit patient in wheelchair for 20mins **Ensure cushion is checked – correct inflation levels; positioned on seat correctly; gel section has been kneaded and has not hardened. Pressure mapping and seating assessment should be organised for today (if team has access to pressure mapping system) A number of seating assessments may be required to ensure cushion and wheelchair are appropriately set up to reduce risk of re-breakdown of skin.	**
		1050	Return to bed, position off area	
		1630	Sit patient in wheelchair for 30mins	
		1700	Return to bed, position off area	
Day 5		1030	Sit patient in wheelchair for 45mins	
		1115	Return to bed, reposition off area	
		1630	Sit patient in wheelchair for 45mins	
		1730	Return to bed, reposition off area	

Day 6		1030	Sit patient in wheelchair for 60mins	
		1200	Return to bed reposition off area	
		1630	Sit patient in wheelchair for 60min	
		1830	Return to bed reposition off area	
Day 7		am	**Patient may shower on a commode chair today. Shower time substitutes X 1 sitting session in wheelchair. If patient does not use a shower commode chair, they should utilise a cushion on their shower chair/ stool. Maximum time on commode/ shower chair is 45 mins**	
		pm	Sit patient in wheelchair for 90 mins	
			Return to bed reposition off area	
			Return to bed, reposition off area	
Day 8		am	Sit patient in wheelchair for 90mins	
			Return to bed, reposition off area	
			Two hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 90mins	
			Return to bed, reposition off area	
Day 9		am	Shower on commode/ chair/ stool for maximum of 45 mins	
		am	Return to bed, reposition off area	
		am	Sit patient in wheelchair for 2 hours	
			Return to bed, reposition off area	
			Two hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 2 hours	
			Return to bed, reposition off area	
Day 10		am	Shower on commode/ chair/ stool for maximum of 45 mins	
		am	Sit patient in wheelchair for 2 ½ hours	
			Return to bed, reposition off area	
			Two hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 2 ½ hours	
			Return to bed, reposition off area	
Day 11		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 3 hours	
			Return to bed, reposition off area	
			Two hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 3 hours	
			Return to bed, reposition off area	
Day 12		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 3 hours	
			Return to bed, reposition off area	
			Two hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 3 hours	
			Return to bed, reposition off area	
Day 13		am	Shower on commode/ chair/ stool for a maximum of 45 mins	

			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 3 ½ hours	
			Return to bed, reposition off area	
			Two hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 3 ½ hours	
			Return to bed, reposition off area	
Day 14			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 3 ½ hours	
			Return to bed, reposition off area	
			Two hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 3 ½ hours	
			Return to bed, reposition off area	
Day 15		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 4 hours	
			Return to bed, reposition off area	
			One hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 4 hours	
			Return to bed, reposition off area	
			Return to bed, reposition off area	
Day 16		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
			One hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 4 hours	
			Return to bed, reposition off area	
Day 17		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 4 ½ hours	
			Return to bed, reposition off area	
			One hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 4 ½ hours	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 4 ½ hours	
Day 18		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		pm	Sit patient in wheelchair for 4 ½ hours	
			Return to bed, reposition off area	
Day 19		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 5 hours	
			Return to bed, reposition off area	
			One hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 5 hours	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 5 hours	
Day 20		am	Shower on commode/ chair/ stool for a maximum of 45	

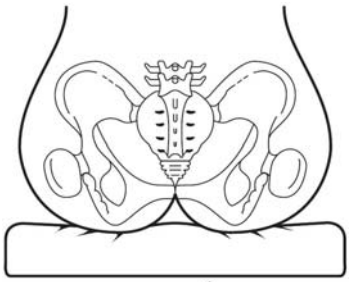
			mins	
			Return to bed, reposition off area	
		pm	Sit patient in wheelchair for 5 hours	
			Return to bed, reposition off area	
Day 21		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 5 ½ hours	
			Return to bed, reposition off area	
			½ hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 5 ½ hours	
			Return to bed, reposition off area	
Day 22		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 5 ½ hours	
			Return to bed, reposition off area	
			½ hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 5 ½ hours	
			Return to bed, reposition off area	
Day 23		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
		am	Sit patient in wheelchair for 6 hours	
			Return to bed, reposition off area	
			½ hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 6 hours	
			Return to bed, reposition off area	
Day 24		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
		am	Sit patient in wheelchair for 6 hours	
			Return to bed, reposition off area	
			½ hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 6 hours	
			Return to bed, reposition off area	
Day 25		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
		am	Sit patient in wheelchair for 6 ½ hours	
			Return to bed, reposition off area	
			½ hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 6 ½ hours	
			Return to bed, reposition off area	
Day 26		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
		am	Sit patient in wheelchair for 6 ½ hours	
			Return to bed, reposition off area	
			½ hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for 6 ½ hours	
			Return to bed, reposition off area	
Day 27		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
		am	Sit patient in wheelchair for 7 hours	
			Return to bed, reposition off area	

			½ hour bed rest between sitting sessions	
		pm	Sit patient in wheelchair for maximum of 7 hours	
			Return to bed, reposition off area	
Day 28		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
		am	Sit patient in wheelchair for 7 hours	
			Return to bed, reposition off area	
			15 mins bed rest between sitting sessions	
		pm	Sit patient in wheelchair for maximum of 7 hours	
			Return to bed, reposition off area	
Day 29		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
		am	Sit patient in wheelchair for 7 ½ hours	
			Return to bed, reposition off area	
			15 mins bed rest between sitting sessions	
		pm	Sit patient in wheelchair for a maximum of 7 ½ hours	
			Return to bed, reposition off area	
Day 30		am	Sit patient in wheelchair for 7 ½ hours	
			Return to bed, reposition off area	
			15 mins bed rest between sitting sessions	
		pm	Sit patient in wheelchair for a maximum of 7 ½ hours	
			Return to bed, reposition off area	
Day 31		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
		am	Sit patient in wheelchair for 8 hours	
			Return to bed, reposition off area	
			15 mins bed rest between sitting sessions	
		pm	Sit patient in wheelchair for a maximum of 8 hours	
			Return to bed, reposition off area	
Day 32		am	Shower on commode/ chair/ stool for a maximum of 45 mins	
			Return to bed, reposition off area	
			15 mins bed rest between sitting sessions	
		pm	Sit patient in wheelchair for a maximum of 8 hours	
			Return to bed, reposition off area	
Day 33 - 34			Increase sitting time by ½ hour (8 ½ hours) Continue 15 mins bed rest between sitting times	
Day 35 - 36			Increase sitting time by ½ hour (9 hours) Continue 15 mins bed rest between sitting times	
Day 37 - 38			Increase sitting time by ½ hour (9 ½ hours) Continue 15 mins bed rest between sitting times	
Day 39 - 40			Increase sitting time by ½ hour (10 hours) Cease bed rest unless skin checks demonstrate delayed blanching or other reason to be concerned	

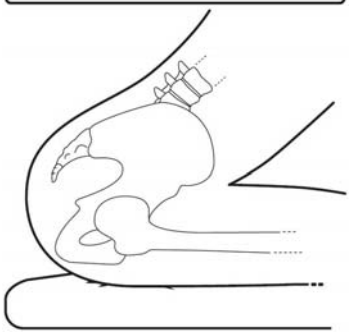
Module 8, part 8:

Weight shift postures

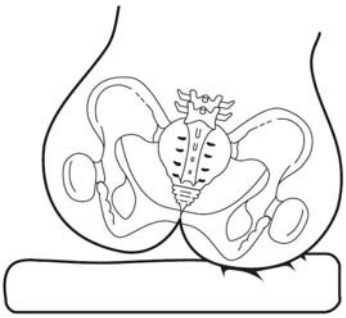
Seated normally in chair



Forward Lean'



'Side Lean'



'Tilt n Space'

http://marketing.sunrisemedical.com/scripts/PortWeb.dll?original=2452&catalog=imgLib

'Push up'