Seating and Pressure Ulcers: Clinical Practice Guideline
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Summary
Pressure ulcers (bedsores) often develop following prolonged sitting especially where people are immobile or are unable to feel discomfort due to injury or disease. This guideline provides health professionals with specific recommendations intended to minimise any risk of developing pressure ulcers when their clients are seated. The guideline covers sitting when people are acutely ill in hospital and, more commonly, where people have a long-term need for prolonged sitting for example after spinal injury. Particular focus is placed upon the need to make sure the physical size and shape of the seat is appropriate for the seated individual. Guidance is provided upon areas where seated individuals require information to help them minimise pressure ulcer development. The advantages and disadvantages of different cushion materials are described.

Background and need for the guideline
When seated a high proportion of body weight is supported by the ischial tuberosities and buttocks, the sacrum and upper thighs. Further body weight is supported by the arms (where armrests are in use) and the feet. Prolonged sitting combined with the high mechanical loads exerted over small body areas gives rise to pressure induced soft tissue damage in individuals vulnerable to these wounds primarily the immobile and those with neurological impairment. The correlation between being seated and the presence of pressure ulcers has been reported frequently since epidemiological studies of pressure ulcer occurrence began. Jordan and Clark (1976) reported the first large-scale pressure ulcer prevalence survey in the United Kingdom and noted that the highest percentage of patients with pressure ulcers involving a break to the skin occurred not among those restricted to bed (18.6%) but in the cohort who were chair fast but totally dependent upon others to mobilise them (24.8%). This group also exhibited the highest percentage of the most severe form of pressure ulcer (4.0% with Grade 4 pressure ulcers). Other surveys have also shown this association between being seated and having pressure ulcers (David et al 1983, Clark and Cullum 1992, among others). While the correlation between being seated and the presence of pressure ulcers has often been reported in cross-sectional studies direct causal association between sitting and the development of pressure ulcers has also been reported (Gebhardt and Bliss 1994) and those who are wheelchair dependent experience pressure ulcers at a relatively young age (Stockton and Parker, 2002).

Despite the awareness that being seated has been associated with pressure ulcers little specific guidance exists to help make care optimal when considering the use of chairs and wheelchairs among people who may be prone to pressure ulcer development. Within the guidance upon pressure ulcers issued by NICE in the United Kingdom (2005) the only comments upon seating covered four sentences stressing the need for qualified assessment for seating needs, the importance of correct seating positions, the need to maintain posture and support the feet when using a wheelchair and the lack of comparative data upon the effectiveness of seat cushions.

In the absence of specific guidance upon seating and pressure ulcers this guideline sets out recommendations for health professionals through which pressure ulcer incidence can be reduced.

Methodology
This clinical guideline was proposed by the Tissue Viability Society, a UK based registered charity that has provided wound management education for health professionals since 1981. The development of the guideline was funded by the Tissue Viability Society through its own reserves and was further supported by an unrestricted educational grant from ArjoHuntleigh.

A literature search was undertaken in February 2008 and updated at six monthly intervals until March 2009. This search was based upon the following key words — pressure ulcer (and other terms for the same wounds – bedsore, decubitus and pressure sore), seat, cushion, and wheelchair. Using these key words searches of the electronic databases MEDLINE, CINAHL, AMED, EMBASE and the Cochrane Library were undertaken. Hand searching of relevant conference proceedings was also undertaken covering the European Pressure Ulcer Advisory Panel and the European Wound Management Association annual meetings. These searches identified few rigorous clinical studies upon which guideline recommendations could be based. For example only 4 randomised controlled trials were found that examined the role of seat cushions in pressure ulcer healing (n=2) and prevention (n=2). The absence of evidence means that guidance may have to be pragmatic rather than fully informed by a wealth of available studies. This clinical practice guideline can therefore at best be considered to be informed by the limited primary data available upon the effect of sitting upon pressure ulcer prevention and healing and largely based upon consensus opinion.

The first draft of the guideline was developed by a panel of three members of the Tissue Viability Society all with previous published research in seating and pressure ulcers -
Dr Michael Clark, Department of Wound Healing, School of Medicine, Cardiff University, Dr Krzysztof Gebhardt, St George’s Healthcare NHS Trust and Dr Lesley Stockton, School of Health Sciences, University of Liverpool. The initial draft was circulated to the Trustees of the Tissue Viability Society for comment prior to presentation at the Tissue Viability Society annual conference in April 2008. Conference delegates and the wider health professional community were invited to comment upon the draft guidelines presented on the Tissue Viability Society website and published in the Journal of Tissue Viability. Two further rounds of consultation occurred following presentation of the draft guidelines at the European Wound Management Association conference (Lisbon, May 2008) and the European Pressure Ulcer Advisory Panel conference (Bruges, September 2008). The draft guideline was also made available to the main Guideline Development Group of the International Pressure Ulcer Guidelines project (www.pressureulcerguidelines.org). No specific consumer involvement occurred during the development of this guideline with consultation targeted at healthcare professionals.

Following consultation the guideline text and recommendations were finalised with the recommendations presented in purple bold italics. All recommendations in this guideline are considered to be offered at the expert opinion level. No cost questions were considered although some of the recommendations may have impact on health care resources — quantification of these costs and the potential benefits in terms of reduced pressure ulcer incidence are outside the scope of this guideline.

Dissemination of the guideline to health professionals will be through the Tissue Viability Society’s website, its quarterly publication the Journal of Tissue Viability, through distribution at conferences both in the UK and wider in Europe and through distribution channels offered by ArjoHuntleigh and other commercial supporters of the Tissue Viability Society. Guideline implementation will be monitored after 12 months dissemination has occurred following the route described by Meijers et al (2007) for assessment of the uptake and use of single issue clinical practice guidelines.

Populations and care settings covered by this guideline

This guideline is applicable to all settings and separates people into two populations:

Chronically at risk

Present with a long-term (often life-long) risk due to effects of trauma (Spinal Cord Injury), disability (for example Spina Bifida), degenerative disease (Multiple Sclerosis for example) and frailty associated with extreme old age.

Acutely at risk

Present with a short-term (usually no more than 2 weeks) risk associated with acute illness, recent trauma, surgery and sedation in intensive care.

It should be noted that a period of acute risk may be followed by long-term risk (patient sustaining spinal injury) and chronic risk can become acute (paraplegic patient developing concurrent illness, for example, development of a urinary tract infection or chest infection).

In this guideline the chronically at risk group will be referred to as the ‘long-term seated’ while the acutely at-risk will be described as the ‘acute population’.

Where do pressure ulcers develop while sitting down?

The potential sites for pressure ulcer development (Figure 1, page 6) when seated are the:

- Ischial tuberosities
- Sacrum
- Trochanter
- Popliteal fossa (at the back of the knee)
- Bony prominences of the spine
- Scapula
- Heels

Other sites may be affected, although less frequently and these may include the elbows, medial aspect of knees, palms of the hand during manual wheelchair propulsion, and the genitals in some seated individuals with severe postural difficulties.

Correct seated posture and seat adjustments

Regardless of the population there are common issues that relate to seating which will be discussed prior to the consideration of the specific needs of the long-term seated and the acute populations.
Correct seated posture
This guideline takes as its foundation the concept that the correct seated posture for any individual is that which does not impede their mobility or their ability to carry out all activities and functions they may wish to perform. In this model a bad or incorrect seated posture is one which would prevent an individual from achieving optimal occupational performance. Seated stability and ease of transfer may be as important to consider as the degree of pressure redistribution offered by a seat or cushion.

Do not seat an individual in such a way as to restrict or limit the activities they may wish to perform

Do not select cushions or seats solely on their ability to manage tissue loads

Seat dimensions and the prevention of pressure ulcers
The variables to consider when preventing pressure ulcers while seated in wheelchairs or armchairs should include the adjustment of the chair with consideration given to the:
- Height of the seat
- Depth of the seat
- Width of the seat
- Backrest height
- The angle between the seat and the back of the chair
- Design of the armrests

Consider the physical dimensions of the seat – are they appropriate for the individual or should they be adjusted

Seat height and depth
If seat is too high, the individual will slide forwards in order to place their feet on the floor to support them. If the seat is too high or too long then sacral sitting is likely to result (Figure 2). This will cause an increase in friction and shear and so increase the risk of pressure ulceration. To check the appropriateness of the height of the seat for an individual make sure that the individual is able to sit with their feet placed on the floor. There should be at least a space between the back of the knee and the front of the seat equal to the width of two fingers, (Figure 3). If the person is seated in a wheelchair make sure that they can place their feet upon the footplates comfortably, as correct adjustment of footplate height has been shown to reduce peak pressures by as much as 50% (MDA, 1997). However, it is important to note that not all elderly and disabled individuals are able to place their feet flat on the footplate and in these circumstances the footplates may need to be angled.
If the seat is too long, the seated individual is likely to slide forward to allow them to bend their knee and place their feet either on the floor or the footrests of a wheelchair. As the individual slides forward they will ultimately rest upon their sacrum with resulting high pressures and the generation of shear and friction. Pressure ulcers may also occur behind the knees if the seat presses against the back of the knee. If the seat is too short this will lead to only part of the thighs bearing load so increasing the pressure exerted on the upper thigh.

**Seat width**

If the seat is too narrow, it will pose several challenges for the seated individual. Their movements may be restricted while transfers may be impeded. If the seat is too narrow and the individual is in contact with both sides of the seat this may increase pressure at the hips and lead to pressure damage. There should be a minimum of 2.5cm clearance between the hip and the side of the seat.

**Armrest design**

Seat armrests are particularly important for the elderly and those with impaired balance when standing up from the seat or when sitting down. Factors to consider include the design of the armrests, their height, thickness and position relative to the seat. Armrests are used in several ways during sitting for example, to assist in maneuvering one-self forward when sitting, to push up from when standing, to lean onto when adjusting one’s posture, and as a support to perform pressure relief movement.
Assessment of seating for the long-term seated population

Factors that should be considered when planning seating for the long-term seated should extend beyond the correct adjustment of the seat for the individual. Assessing the need for seating should be performed by an individual who is trained ideally in discussion with the individual and family and/or carer. Seating assessments may include the following issues in combination with clinical judgement:

- Cognitive ability of the seated individual
- Level of independence
- Psychosocial issues
- Posture
- Ability to pressure relieve
- Motivation to pressure relieve
- Interface pressure
- Moisture and temperature at the seat buttock interface
- Ability to transfer
- Absent or partial sensation
- Pressure ulcer history including previous sites of pressure damage (risk of recurrence at healed sites)
- Continence management
- Comfort
- Method of transfer
- Method of wheelchair propulsion
- User and carer opinions
- Previous use of cushions

Providing information to the seated person, their family and/or carer

A key part of any seating assessment is the requirement to inform the individual, their family and carers (where present) upon why special seating or cushions may be provided and how to use and maintain this equipment. This information should be explained to the individual with supplemental written information provided.

A vital part of this education process is to explain factors that may suddenly increase their susceptibility to developing pressure ulcers – these ‘flash factors’ may include the following:

- Vomiting
- Urinary infection
- Dehydration
- Influenza
- Changes in bowel activity (eg: diarhoea, constipation)
- Increased alcohol consumption
- Depression
- Changes of routine (long journeys, holidays)
- Family/life changes

These factors may cause the individual to move rapidly from the long-term seated group to the acute population and prompt seated care relevant to the acute population.

Inform the individual, their family and/or carer about factors that may increase their vulnerability to pressure ulcers

Inform the individual, their family and/or carer upon the correct use and maintenance of their seat and/or cushion

Instruction on early changes in skin appearance and on the first signs of pressure ulcer development may be considered, however it may be challenging for an individual alone to view their buttocks to assess for signs of incipient pressure damage even if a mirror has been recommended to help with this task.
Self-Repositioning Programmes

Guidance upon self-repositioning may be provided in certain client groups as part of their routine care, for example those with spinal cord injuries within specialist rehabilitation centres; young individuals with congenital conditions whilst in school. For the wider wheelchair user population wheelchair centres may also provide instruction upon self-repositioning.

Within community or hospital settings, seated individuals where appropriate should be advised to perform pressure relief movement. This intentional movement can be undertaken in three main ways (Figure 4):

*Roll* when the individual raises one buttock at a time by leaning or rolling sideways, and this movement usually relies upon the use of armrests for support. This intentional movement may not require such a high level of physical capability as a lift-off, but it does require a degree of trunk control in order to regain a stable seated posture.

*Forward lean* when the individual leans forwards with their chest moving towards their thighs whilst their buttocks remain in contact with the seat. Although this movement does not take the buttocks away from the seat it can alleviate pressure underneath the ischial tuberosities. For some individuals “forward leaning” may result in an episode of urinary incontinence if the bladder is compressed when full. (Henderson et al, 1994).

*Lift-off* when the individual pushes down onto the chair armrests taking their weight through their arms to lift the buttocks away from the seat. This requires good upper body strength and over a period of time the repetitive movement may place a strain upon the shoulder joints, leading to shoulder pain (Nawenski, Globes, Core et al 2003) and this movement may become more difficult as a person ages.

It is generally recommended that purposeful, planned pressure relief movement is undertaken every 15-30 minutes (AHCPR 1992; Dept of Health 1994, NICE 2001) to encourage tissue reperfusion. However the practicality, effect on pressure ulcer formation and acceptance of this practice is unclear.

Encourage the individual where appropriate to perform regular small shifts of position

Provision of seats, wheelchairs and cushions

Given the wide range of chairs, wheelchairs, and seat cushions available, and the wide range of physical conditions for which they may be prescribed it is not possible to provide specific guidance upon which cushion or seat to provide for each individual with long-term seating needs. However general guidance upon provision can be extended;

People with seating needs must have the ability to rapidly access advice and equipment from wheelchair or community services to prevent any problems deteriorating into pressure ulceration. Ideally assessment and provision of seats and cushions would be available on a 24 hour basis however this is probably unrealistic in the care settings where the long-term seated group is likely to be encountered.

The long-term seated population need to have regular follow-up for their pressure-redistribution needs, which would lead to a change or replacement of equipment if necessary. It is important to consider the durability of the cushion and to plan for future reassessment and replacement if necessary.
Ensure rapid access to seating and plan reassessment on a regular basis

The provision of seat cushions should not be based solely upon the outcome of a pressure ulcer risk assessment tool, as these tools were not designed to identify risk for those who sit for prolonged periods or for wheelchair users (Wall, 2005)

The use of interface pressure measurements, including pressure mapping may assist the selection of a cushion that distributes load from vulnerable bony prominences (Crawford, Stinson and Walsh, 2005) although the measurement and interpretation of this data can be problematic (Goossens, Tseeuw and Snijders 2005; Rithalia 2005). Pressure measurements are only one consideration in the determination of correct seating, which is in itself a complex process.

Do not base cushion or seat selection upon the results of risk assessment scores or upon interface pressure measurements

Placing a flat plywood base-board beneath a seat cushion has been found to substantially increase peak pressures and should be avoided (MDA 1997).

The use of foot stools may impede leaving the chair and may cause heel pressure ulcers if inappropriately positioned.

Avoid the use of additional equipment such as base-boards and footstools within the seat and its immediate environment

There may need to be a trade-off between what the clinically ideal seating would be, and what is manageable for the individual’s lifestyle and capabilities, this is particularly appropriate for sophisticated cushions and seats that may require regular readjustment or vigilance to maintain their correct operation.

Cushion selection

There are many different types of pressure redistributing cushion available to help prevent and manage pressure ulcers.

Understand the advantages and disadvantages of the various forms of cushions available to assist pressure ulcer prevention and management

Advantages and disadvantages of cushion materials to consider in cushion prescription

Static cushions such as those made using foam, gel or air are based upon the premise that the constant pressure at the buttock/cushion interface will be sufficiently low to allow perfusion within both deep and superficial tissues thereby avoiding tissue damage.

For static cushions, low maximum interface pressures are important as these will be experienced indefinitely until the individual makes a conscious effort to lift themselves as part of their self-repositioning programme.

Foam cushions

Foam cushions vary by density with high density foams tending to be more durable. Apart from density another key parameter is the foam’s ‘memory’ that is its ability to return to its original shape once load is removed.

Advantages

- Relatively inexpensive
- Stable support surface
- Some have bacterial control within the core of the cushion
- Quickly warms up and retains heat
- Sculpted or machine-profiled foam cushions maximise the contact area between the individual and the cushion
- Easy to use
Foam cushions

Disadvantages
- Lower quality foam cushions may require replacement after 6-12 months use
- The cushion may only be suitable for people below a certain weight – look for safe weight limits marked on the cushion or supporting documentation
- Poor quality foams may fatigue and ‘bottom out’ quickly. Fatigue can be identified through visual inspection of the cushion once load has been removed – does the top surface of the cushion have a lowered centre and higher edges?
- Heat and moisture may build up between the cushion and the buttocks – hot damp skin and soft tissue may be at elevated risk of breakdown during prolonged sitting

Oil-based foam cushions
These cushions were initially designed for impact absorption consequently they may be useful to consider in the case of wheelchair users who experience pain (for example those with Rheumatoid Arthritis or cancers).

Advantages
- Moulds to buttocks so increasing the surface area in contact with the cushion so reducing maximum interface pressures
- Warms up relatively quickly to allow moulding to the buttocks
- Moulding to buttocks helps to anchor the pelvis upon the seat
- Stable seat support

Disadvantages
- If stored before use in a cold environment can feel firm until the material warms up
- Moulding to the buttocks may impede sideways transfers for some users

Gel cushions
Gel cushions vary upon the viscosity of the gel used in their construction. High viscosity gels are more solid and can be used in sheets and as an upper layer on some foam cushions. Lower viscosity gels are more fluid.

Advantages
- Mould to the shape of the buttocks so increasing the surface area in contact with the cushion so reducing maximum interface pressures
- Conducts heat away from the skin surface so may feel cool to the user

Disadvantages
- The movement of low viscosity gels may be noticeable to the user and affect their seated balance and ability to transfer from the seat.
- Low viscosity pure gel cushions will leak if punctured.

Air cushions
Air filled cushions are lightweight and depend upon the amount of air flow into the cushion and the shape of the air chambers for their pressure redistributing properties. Where individual compartments are present within the cushion some degree of postural support and adjustment can be provided by these cushions.

Advantages
- Lightweight and easy to move
- Air circulation may disperse heat and moisture build-up

Disadvantages
- Can feel a little unstable for some users
- May be difficult to transfer from
- Client/carer education required
- Regular maintenance required to maintain correct operation
- Can be punctured

Dynamic cushions (also known as alternating cushions or active therapy)
Dynamic seat cushions periodically off-load the tissue without physical movement from the user. They are based upon regular inflation and deflation of the air cells within the cushion every 10-12 mins.

Advantages
- The alternating high and low pressures inside the cells enable sequential off-loading thereby facilitating reperfusion (Stockton and Rithalia 2008)
- The frequency and degree of off-loading is automated for those who are unable to move, for example, advanced neuromuscular conditions, SCI.
- Periodic off-load is not dependent on conscious intervention

Disadvantages
- Periodic off-load is not dependent on conscious intervention which may prevent other beneficial effects of movement for example, spinal disc nourishment, maintenance of muscle tone.
May affect perception and balance in some individuals with SCI.

Correct use depends upon psychosocial circumstances, in terms of cognitive ability to manage and monitor equipment.

Need to be connected to power supply or maintain battery in charged state.

Cost of equipment can be higher than other types of seating.

**Cushion covers**

The selection of an appropriate cushion cover can influence seating — for example a smooth surface cover, compared with a towelling-type or wool-pile cover, may ease sideways transfers for those who are weak or with a degenerative neurological condition.

Maintenance or loss of body heat may also influence the selection of cover materials. Where less body heat is generated for example in the frail elderly a wool-pile or towelling cover may be preferable whereas in young active wheelchair users similar covers may promote heat and moisture build-up.

For the incontinent individual ease of cleaning the cover is crucial and where the cover can be detached from the cushion a covered zip is required.

As with the care of the cushion itself the individual, their family and/or carer require to be informed regarding the care of the cushion cover. This education needs to cover how to detach, launder and reapply the cover taking account of instructions that may be printed on the cover or cushion for example location of the front or top surface of the cushion or cover.

Consider the use and care of the cushion cover as being of equal importance to the selection of the cushion itself.

**Tilt-in-space wheelchairs**

For those who are unable to self-reposition tilt-in-space wheelchairs are sometimes useful. In these wheelchairs the seat and backrest angles remain fixed as they are tilted backwards with the occupant remaining in the same posture as the seat and back tilt.

**Advantages**

The posterior tilting position by 20 degrees in a tilt-in-space wheelchair can reduce load taken through the ischial tuberosities (Michael, Porter and Poutney, 2007).

**Disadvantages**

May have a negative effect on breathing and promote muscle spasms for some wheelchair users.

The tilt-in-space wheelchair may be incompatible with the wheelchair users’ environment, for example the height may preclude the use of tables and desks.

The space required to safely turn and move the wheelchair is increased due to the position of the footplates and push-handles when the wheelchair is in its tilted position.

Cost of equipment can be higher than other types of seating.

Management of pressure ulcer risk while seated does not have to depend upon cushions, specialist equipment such as tilt-in-space wheelchairs may also have a role to play.

The long-term seated population with established pressure ulcers

Where individuals present with established pressure ulcers there needs to be consultation with the individual to establish their personal priorities. Those with pressure ulcers in the community who receive district nursing care are likely to have significantly more reduced self-care and mobility, and less wish to engage in social functioning than those without pressure ulcers receiving district nursing care (Franks, Winterberg and Moffat 2002). While restriction of chair use may be the apparent solution to promote healing of severe pressure ulcers (Grades 3 and 4) for some individuals receiving district nursing care in the community, this may restrict an individual’s life style and ability to work. The risks of continued chair use should be explained and an informed decision reached and documented. In the management of severe pressure ulcers, an agreed change of seating system may be required, for example, a more sophisticated pressure-redistributing cushion for the individual may be considered. Where the individual presents with superficial pressure damage the potential risks associated with continued seating need to be presented and explained. Changes in lifestyle and health behaviours that may influence tissue integrity could be considered by the individual, for example, nutrition, smoking, medicinal or recreational drug use, repositioning schedule. All discussion regarding continued sitting with established pressure ulcers should be...
documented. At any change in an individual's health condition a reassessment of their seating needs and current equipment provision should be performed.

Reach an informed decision where appropriate with people who have existing pressure ulcers and who wish to continue sitting regarding the risks of developing more severe ulcers and the potential for their ulcers to fail to heal rapidly.

Key seating outcomes for the long-term seated individual
The main outcomes that should be documented for the long-term seated individual should include whether the assessment and equipment provision for pressure relief has:

- Maintained their occupational performance
- Provided satisfaction
- Maintained their health-related quality of life.

Pressure ulcer prevention and treatment may not be the key outcome for long-term seated individuals

Seating for the acutely ill individual
Assessment for the acutely ill individual’s vulnerability to pressure ulcer development should be based on consideration of risk factors such as immobility, poor sensory perception, incontinence and current medical problems. This assessment could be supplemented through use of a pressure ulcer risk assessment tool within the ward setting.

If an acutely ill individual is established to be at risk of pressure ulcer development they should sit for no longer than 2 hours at a time then be returned to bed (ideally with a pressure redistributing mattress), or where appropriate the individual should be encouraged to walk and then lie down and rest, and to avoid sitting down again within an hour.

All hospital chairs used by acutely ill at-risk individuals should be capable of adjustment of the seat height from the floor by staff trained to undertake this modification. Adjustment of other seat variables such as width and depth should also be undertaken. There should be no need for supplementary use of seat cushions where variable height/width/depth chairs are present, if the chair seat upholstery is in good condition and the seat is correctly adjusted and the individual is assisted to pressure relieve.

If an additional cushion is added to an existing armchair, the chair dimensions, the positioning of the individual to avoid shear, and the ability of the individual to safely stand from sitting are important factors to consider. The health and safety impact of adding an additional cushion onto a chair should be considered. The main outcome for the acutely ill, at-risk individual is the avoidance of pressure ulcers recorded through pressure ulcer incidence.

Limit sitting time among the acutely-ill seated population
Consider the use of adjustable seats and assisted repositioning where possible rather than cushions in the prevention of pressure ulcers in the acutely-ill.

Avoidance of pressure ulcers is a key outcome for the seated acutely ill individual
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