Hand checks: Are They an Effective Method to Monitor Support Surfaces for Bottoming Out?  
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**Introduction**

The use of therapeutic support surfaces is an essential component of comprehensive Pressure Ulcer Prevention Programs. In order to achieve quality outcomes, ongoing monitoring of support surface function is crucial. One recommendation for bedside monitoring of support surfaces on a regular basis is to implement a ‘hand check’ to assess that the surface is providing adequate pressure redistribution and is not ‘bottoming out’. The purpose of this paper is to raise awareness of the issues related to safety and efficacy for the recommended methods for bedside monitoring of therapeutic support surfaces for bottoming out and to recommend changes in implementing this monitoring function. No evidenced-based research exists to support the practice of using hand checks. With advances in therapeutic support surfaces and mattress replacement systems, hand checks are not an effective or safe assessment technique to monitor these newer technologies

**Background**

A therapeutic support surface as defined by the National Pressure Ulcer Advisory Panel (NPUAP) Support Surface Standards Initiative (S3I) is “A specialized device for pressure redistribution designed for management of tissue loads, micro-climate, and/or other therapeutic functions (i.e. any mattress, integrated bed system, mattress replacement, mattress overlay, seat cushion, or seat cushion overlay)” (Posthauer ME et al., 2006) (RESNA, 2014). The S3I further defines bottoming out as “The state of support surface deformation at which no increase in mattress/overlay deformation occurs when further loading is applied” (RESNA, 2014). The International Pressure Ulcer Guidelines define bottoming out as “occurring when a reactive or an active support surface provides insufficient support to adequately distribute pressure due to excessive immersion; the individual presents as sitting or lying on the underlying structure of the bed or chair.” (2014 International PU Guidelines reference)
Those in bedside practice understand this to mean that the patient has immersed excessively into the surface and that the patient is no longer being supported by the surface, but in fact is resting on the underlying bed frame or support structure; the surface is no longer effectively redistributing pressure. As a body immerses into a support surface the continuing vertical displacement represents increasing immersion. If the mass of the body overwhelms the immersion capacity of the support surface a transition from immersion to bottoming out occurs; this transition has been referred to as critical immersion. This term is potentially misleading and is encouraged to be dismissed from common usage.

The bedside clinician has been tasked to monitor therapeutic support surfaces for bottoming out by performing a routine “hand check”, typically once per shift. This method has been described in the literature as having the clinician slide a hand, palm side up, at the interface of the overlay and the mattress just under the patient’s sacrum. If the clinician can feel the patient’s sacrum resting in the palm of their hand or is not able to feel at least 1” of the inflated surface between the palm of the hand and the patient’s sacrum, the patient is said to be “bottoming out”. Although this method is believed to have begun as a way to evaluate inflation/effectiveness of mattress overlays, it was extended to include replacement surfaces such as foam, low air loss and alternating pressure surfaces. Information published in the Clinical Practice Guidelines; Treatment of Pressure Ulcers in 1994 recommended “hand checks” for mattress overlays and seat cushions as an assessment measure to determine the effectiveness of the surfaces in use for pressure management (AHCPR 1994). By 2000, the hand check was included in additional guidelines to include not only mattress overlays but also mattress replacement systems and integrated bed systems. (Delmarva 2014) In early 2000, there were guidelines that recommended placement of the hand between the individual’s sacrum and the support surface (Paralysised Vets 2000).

In an effort to practice evidenced-based care, a literature search was conducted to evaluate the efficacy of the “hand check” assessment method. Multiple literature searches of PubMed, Ovid and Embase using the keywords ‘bottoming out’, ‘hand check’, immersion, ‘support surface’ yielded no evidence of research studies to validate implementation of ‘hand check’ as a method of performance evaluation. The information noted in the literature review is based solely on professional opinion and tradition with a lack of scientific research to support the clinical practice.

“Bottoming Out” has been referenced in the literature and text books as far back as the 1990’s and remains within guidance documents related to pressure ulcer and support surface interventions but there is virtually no scientific evidence that the subjective “hand check” provides an adequate understanding of an individual’s actual situation on
a specific therapeutic support surface. Based on the findings in the literature, the “hand check” technique was developed at a point in time when the majority of therapeutic support surfaces were designed as mattress overlays. The F-tag 314 cites reference to use of the hand check as a way to determine whether or not a resident is ‘bottoming out’ on a mattress overlay (http://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R5SOM.pdf ). After close review of this document, it is clear that the F-tag 314 referenced mattress overlays and not mattress replacement systems. This technique, while very subjective, may have been adequate for most mattress overlays used over a standard mattress. It is unclear how this assessment method was used by health care providers to determine if a patient was bottoming out on an integrated bed system such as an air fluidized support surface.

Over-time, mattress overlays, mattress replacement systems and integrated bed systems have been designed with technological advances. As the devices have been developed, terms, definitions and testing methods have also been undertaken (Posthauer ME et al., 2006). Device features and benefits have changed significantly from the initial therapeutic support surface overlays. Therefore, the evaluation of their performance and quantification of their clinical relevance must also change.

Patient safety has moved to the forefront of importance when caring for individuals either at risk for pressure ulcer development or receiving treatment for pressure ulcers. Sophisticated support surface designs specifically address patient safety. Specialty straps that secure the mattress replacements and the mattress overlays are used on all surfaces across the spectrum of health care settings. The mattress is secured to the bed frame by trained, educated and certified individuals. The placement and securing of safety straps is a task that should be carried out by individuals that have been specifically trained with this skill to ensure safe and effective use of the support surfaces. The security straps fit tightly on the frame and even though the placement process is time consuming, it is important to prevent patient accidents. Removal of the security straps by the clinician to do a manual, subjective “hand check” for “bottoming out” on a support surface, increases a patient safety risk due to the uncertainty that these straps will be placed correctly with each “bottoming out hand check” by the clinicians.

Secondly, since side rails are now considered a restraint in most health care facilities, many support surfaces also employ the use of a safety perimeter to serve as a gentle reminder that the patient or resident is nearing the edge of the bed in order to prevent patient injuries from falls. Some of these devices are integrated within the specialty mattress but many are additional covers that require a second set of safety straps. Although these devices mitigate fall risk, when a second set of safety straps are used, they become a deterrent from removing straps to perform a ‘hand check” for “bottoming out” by the health care provider.
A third safety issue in the population of patients with fragile skin occurs when a hand check poses potential risk for shearing injury under the boney prominence of the sacrum resulting in the harm of tissue destruction. The risk of performing a hand check outweighs the benefit that might be derived.

Another issue for consideration regarding ‘hand checks for bottoming out’, is that of infection control. When considering support surfaces within a healthcare facility, the FDA has issued a cautionary alert to be vigilant in auditing the integrity of hospital mattresses (http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm348016.htm). In light of that alert, there is insufficient evidence to support a clinician inserting an upper extremity between an overlay and a mattress or within the structure of the mattress itself. That action could precipitate a hazardous situation for the caregiver and the patient.

Another question for thought is, “does the depth of immersion and potential bottoming out change with different patient/resident positions? Bottoming out is a dynamic force subject to a number of variables and positioning may change the individual’s immersion or depth into the support surface at any given time. Health care facilities provide policies, procedures, and protocols for clinicians to check for bottoming out. During the course of a day in a health care facility, the patient or resident is repositioned multiple times. Clinicians are not able to safely implement hand checks with frequent turning and repositioning. These positions have a direct effect on the immersion and envelopment of the patient/resident and are associated with the outcome of pressure ulcer prevention.

Many mattresses and integrated bed systems in use today include self-diagnostic features that indicate proper protective function. While technologies that can be validated are developing that are helpful in measuring bottoming out, they have yet to be widely integrated at the bedside.

**Should hand checks be performed?**

- Hand checks create the potential for infection risks for both the patient and the caregiver.
- Hand checks could create shearing injury of fragile or moisture compromised skin.
- Safe hand checks for bariatric individuals require multiple staff members, and the resultant repositioning alters the immersion making the hand check invalid.
• Hand check characteristics vary with the elevation of the head of the bed and patient positioning.

• Hand checks are subjective and not reliable.

• Certain therapeutic support surfaces are designed so that hand checks for bottoming out cannot be properly performed.

• Visual observation combined with surface compression may be useful to provide indicators of surface immersion failure.

Conclusion

“Hand checks” have been historically used to assess bottoming out of mattress overlays at the bedside. No evidenced-based research exists to support the practice of using hand checks. With advances in therapeutic support surfaces and mattress replacement systems, hand checks are not an effective or safe assessment technique to monitor these newer technologies. The use of hand checks was removed from the International Pressure Ulcers Guidelines in 2014. Additional research is needed to provide a bedside method to determine when a support surface has bottomed out.

References


