Reducing the risk posed by damaged mattress covers by using a non-corrosive, chlorine-free, high level disinfectant

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Introduction

Specialist pressure area care (PAC) patient support surfaces play an essential role in pressure ulcer (PU) prevention and management for all at-risk patients. [1, 2] These support surfaces (mattresses and cushions) are typically classified as;

- 'reactive' surfaces (i.e. static, high performance foam, air or gel which cost £150 to £250+)

OR

- 'active' surfaces; (i.e. alternating pressure air mattresses which cost £500 to £1500+)

Almost all PAC support surfaces use polyurethane coated, multi-stretch, waterproof, moisture vapour permeable covers to help manage the pressure and shear on patients' skin and the microclimate at the patient/support surface interface.

These covers are often easily damaged either as a result of physical wear and tear or as a result of exposure to corrosive or aggressive chemicals such as chlorine based disinfectants.

The majority of healthcare providers' infection prevention and control policies advocate the use of chlorine based disinfectants at 1,000ppm available chlorine for standard cleaning and disinfection and 10,000ppm available chlorine for blood and body fluid spillages and for some terminal cleans post infection.

Whilst chlorine based disinfectants are readily available, offer broad spectrum antimicrobial activity and are typically low-cost, they also have the potential to damage and degrade surfaces, fixtures, fittings and expensive medical devices, all of which will incur additional costs to the provider in the long term as they foot the bill for repair and replacement of the above.

With antimicrobial chemical technologies constantly evolving it is important for healthcare providers to assess and appraise these new disinfectants and to ask the question *'are alternative, disinfectants available which offer equivalent performance to current products but without the recognised drawbacks?'*

Independent laboratory testing by Speight et al has identified a non-corrosive, chlorine free disinfectant technology which performs to the same level as chlorine dioxide. [3]

The disinfectant is TECcare® CONTROL (see Figure 1) which is based on a combination of two quaternary ammonium compounds (QAC), didecyldimethyl ammonium chloride (DDAC) and benzalkonium chloride (BAC).

FIGURE 1.
TECcare CONTROL Concentrate

Aim

The aim of this work was to examine and report any noticeable damage to a selection of PAC mattress cover materials when exposed to TECcare CONTROL and two concentrations of chlorine based disinfectant.

Method

A solution of TECcare CONTROL in its ready for use concentration was tested against two concentrations of a chlorine based disinfectant using multiple 20cm x 20cm sections of three different polyurethane coated, moisture vapour permeable, multi-stretch mattress cover materials (sample A, sample B, sample C).

The three disinfectant solutions used for the testing were as follows;

1. Sodium hypochlorite (at a concentration of 1,000ppm available chlorine)
2. Sodium hypochlorite (at a concentration of 6,500ppm available chlorine)
3. TECcare CONTROL (at a concentration of 660ppm in a ready-for-use solution)

This laboratory based soak test compared the impact of three disinfectant solutions on the three different mattress cover materials over a fourteen day period. The test protocol used is detailed below:

Day 0

- Fresh sodium hypochlorite solutions were prepared at 1,000ppm and 6,500ppm
- Three 20cm x 20cm samples of each mattress cover (samples A, B and C) were cut to size
- Each mattress cover fabric sample was draped loosely over its own beaker and secured in place using elastic bands to create a 'well' which would retain the test disinfectant solution
- 50ml of disinfectant 1 (sodium hypochlorite at 1,000ppm) was pipetted into the well of each mattress cover fabric sample A, B and C
- This process was repeated for disinfectant solution 2 (sodium hypochlorite at 6,500ppm), and disinfectant solution 3 (TECcare CONTROL)
- Test samples were left to soak for 4 days at room temperature (20 – 21°C)

Day 4

- The fluid remaining on each of the nine test samples was tipped away
- Fresh solutions of both sodium hypochlorite concentrations were prepared
- 50ml of each disinfectant was then pipetted back onto each of the corresponding fabric samples which were left to soak for 4 days at room temperature (20 – 21°C)
- NB. This process was repeated again on day 8 and day 12

Day 14

- Remaining fluid from each of the nine test samples was tipped away and testing was terminated
- Visual inspections of each sample were made and photographs taken (see Table 1 and Figure 2)

Results

The results of the mattress cover soak tests are reported in Table 1 and in the photos shown in Figure 2.

Exposure to sodium hypochlorite at 1,000ppm (disinfectant 1) resulted in noticeable fading of each of the fabric samples, with the greatest impact being seen on Sample A. Exposure to sodium hypochlorite at 6,500ppm (disinfectant 2) resulted in significant fading of each of the fabric samples, with the greatest impact being seen on Samples A and B.

Exposure to TECcare CONTROL (DDAC/BAC) at 660ppm active ingredient (disinfectant 3) had no impact on any of the fabric samples on test.

Discussion

It is evident from the results of this laboratory based soak test that exposure to chlorine based disinfectants at 1,000ppm can result in obvious physical damage to the typical polyurethane coated, multi-stretch, waterproof, moisture vapour permeable PAC mattress cover material that is used extensively throughout all healthcare settings. These results indicate that the more concentrated the solution of sodium hypochlorite the quicker the damage will occur and the greater the damage to the cover will be.

	DISINFECTANT SOLUTION	VISIBLE DAMAGE		
		MATTRESS COVER SAMPLE A	MATTRESS COVER SAMPLE B	MATTRESS COVER SAMPLE C
1.	Sodium hypochlorite at 1,000ppm	+++	++	+
2.	Sodium hypochlorite 6,500ppm	+++++	+++++	++
3.	TECcare CONTROL at 660ppm (ready for use)	-	-	-

TABLE 1.
Visual damage to the three different mattress cover samples exposed to the three disinfectant solutions

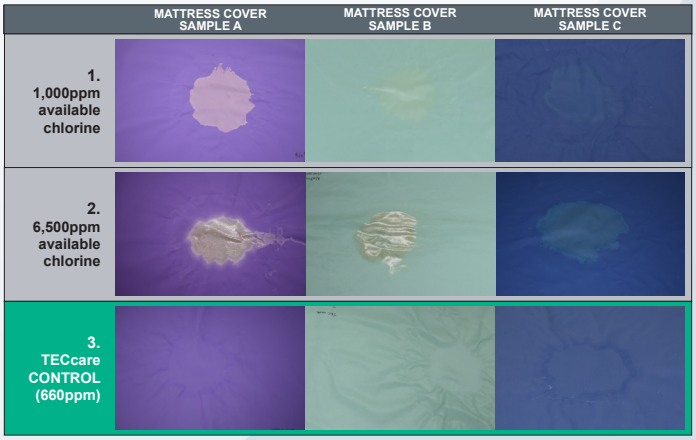

FIGURE 2.
Swatches of mattress cover sample material after 14 days exposure to the three test disinfectant solutions

This work may well have implications for healthcare providers when one considers that almost without exception their infection prevention and control policies for cleaning and disinfection stipulate 1,000ppm available chlorine for 'standard' cleaning and disinfection and 10,000ppm available chlorine for blood and body fluid spillages and in some terminal cleaning situations where infected patients have been cared for.

There can be multiple different causes of mattress cover damage and it is not singularly related to the use of disinfectants, however mattress cover damage is clearly a significant issue for healthcare providers and has previously been raised by the Medicines and Healthcare product Regulatory Agency (MHRA). After receiving numerous reports of damaged mattress covers and associated interior mattress contamination, the MHRA issued Medical Device Alert MDA/2010/002 which stated;

'If mattress covers are damaged, body or other fluids can pass through and contaminate the inner core. There is the potential for cross-infection if contaminated mattresses remain in use.' [4]

Two of the action points arising from the MHRA medical device alert were to;

'safely dispose of any covers showing signs of damage or staining'

and to;

'Arrange for contaminated mattress cores to be either: cleaned and decontaminated in accordance with the manufacturer's instructions; or safely disposed of'. [4]

Either of these actions proposed by the MHRA will have an obvious impact on healthcare provider budgets as they will require increased spend from the provider.

Opting for a non-corrosive, QAC based disinfectant with independently proven antimicrobial efficacy equivalent to current chlorine dioxide disinfectants offers a simple, risk free solution for healthcare providers who wish to eliminate the risk of damage to fixtures, fittings, environmental surfaces and medical devices without compromising on cleanliness and disinfection. With alternative, non-corrosive disinfectants to chlorine now available and independently assessed as delivering equivalent antimicrobial performance [3], it is possible to deliver clean and safe clinical environments and medical devices without incurring the risk of physical damage/degradation of these surfaces by exposing them to aggressive, corrosive chlorine based disinfectants.

Conclusion

Exposure to TECcare CONTROL resulted in no signs of damage to any of the mattress cover materials, however exposure to either chlorine solution resulted in clear signs of damage with higher levels of chlorine (6,500ppm) perhaps unsurprisingly causing greater damage to the cover material on test.

By opting for a high-level, non-corrosive, chlorine free disinfectant, healthcare providers may be able to reduce damage to mattress covers and thereby reduce spend on these items whilst simultaneously reducing the infection risk posed to patients by damaged covers.

References

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2. National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers: Quick Reference Guide. Emily Haesler (Ed.). Cambridge Media: Osborne Park, Australia; 2014.
3. Speight S, Moy A, Macken S, Chitnis R, Hoffman PN, Davies A, Bennett A, Walker JT. Evaluation of the sporicidal activity of different chemical disinfectants used in hospitals against Clostridium difficile. J Hosp Infect. 2011 Sep;79(1):18-22.
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