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Brief report

Improving operating room cleaning results with microfiber and steam technology

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Microfiber and steam technology is a novel cleaning method that has advantages for clinical applications. We describe its use in the operating room. The benefits include improved cleaning for every patient regardless of known or perceived risk, occupational health and safety advantages, and reduced cost of cleaning, allowing for expansion of cleaning activity without the need for additional human resources. Continuous surgical site infection surveillance demonstrated that infections remained at previously low levels.

Microfiber and steam technology is a cleaning methodology that excludes the use of chemicals for environmental cleaning. In August 2013, microfiber and steam technology was introduced into the operating suite at Moorabbin Hospital, part of the Monash Health system in Victoria, Australia. This is the first operating theater in Australia to adopt chemical-free cleaning. The use of microfiber and steam technology in this setting follows its introduction into intensive care units and clinical wards across the Monash Health system.[1-3]

The aims of introducing microfiber and steam technology included reducing the risk of slips and falls, along with improving cleaning outcomes. This new cleaning technology was implemented after a nurse slipped and fell on a wet floor when entering an operating theater following overnight cleaning.

The technique involves using microfiber cloths dampened with water to clean surfaces in the operating room between patient admissions. This includes the operating table, scrub trolley, theater lights, and anesthesia machine. Steam with microfiber is used for end-of-day cleaning of difficult-to-access areas, including operating table joints, mobile equipment joints, and instrument pedals, as well of for a final cleaning of floors. Steam cleaning uses 97% dry steam to dislodge organic matter. The microfiber cloth then picks up the loosened matter. Because microfiber cloths are only dampened, not saturated, they are suitable for cleaning delicate items, such as keyboards, electrical leads, and computer screens. No chemicals are used, and scrubbing is not required.

Operating suite management was concerned that conventional cleaning had not been achieving optimum results. By reviewing how resources were allocated, an evaluation of this cleaning technology might provide an opportunity to reconfigure scarce resources and achieve an expansion of cleaning.

Several cleaning schedules had been in use, covering the majority of areas of the operating suite, but nurses were aware that not all areas were included. Discussions around designated roles and duties had identified some difficult-to-resolve cleaning issues for operating suite staff and environmental cleaning staff.

METHODS

Monash Health is Victoria's largest metropolitan health service, with 2,150 beds and more than 14,000 staff members. Moorabbin Hospital is a 147-bed acute medical-surgical hospital incorporating Monash Cancer Centre. The surgical specialities include elective orthopedic joint replacement; urology; gynecology; ear, nose, and throat; breast; plastic reconstructive; maxillofacial; and general surgery. The hospital has 6 operating rooms that function 5 days per week and does not have an emergency department. The level 2 operating suite (with 4 operating rooms) started using the microfiber and steam technology in August 2013. The level 3 operating suite (with 2 operating rooms reserved principally for orthopedic cases) began using the new technology in January 2015.

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When the microfiber and steam technology was introduced, there were 3 theater assistants covering a 10-hour period, 5 days per week (50 hours per week for cleaning and related activities) and 2 cleaning staff covering a 4-hour period, 5 days per week (40 hours per week for cleaning and related activities). The new cleaning method was instituted following an education program for cleaning and clinical staff, developed in collaboration with the Infection Control Department. The cleaning education program involved 3 designated environmental services staff and 3 theater assistants and their managers. All 62 nursing staff and 7 operating suite technicians who clean clinical equipment during operating hours also received cleaning education and training.

Random fluorescent marking was introduced for environmental assessments. This involved regular application as described previously.[4,5] Assessment involved a 10-point high- touch operating room audit. Management provided feedback on results to staff. Credentialing of both designated cleaning staff and theater staff, using the fluorescent marker, was introduced to demonstrate competency. Fluorescent marker assessments continued until alignment with the cleaning procedure and effectiveness of the cleaning were demonstrated.

All cleaning of clinical equipment is done by clinical staff (nurses, operating suite technicians, and theater assistants), whereas environmental cleaning, including walls, floors, and scrub sinks, is done by designated cleaning staff. Environmental cleaning is performed overnight when the operating suite is closed.

Surgical site infection rates for knee and hip joint replacements have been monitored continuously at Moorabbin Hospital since 2002. Deep surgical site infections before and after implementation of the new technology were compared.

RESULTS

Cleaning process

The use of microfiber and steam cleaning was met with approval by environmental cleaning staff, who became comfortable with its use within 2 weeks of its introduction. Feedback was positive, and cleaning staff were excited and actively contributed to training their peers.

Ongoing education reinforced the new cleaning technique. The introduction of this new technique promoted a review of schedules, with those areas not requiring as much cleaning appropriately minimized. For instance, daily mopping of the reception area floor was reduced to every other day. Cleaning was streamlined, facilitating targeted cleaning in higher-risk or difficult-to-access areas using available resources.

Visually, the operating theater now appears cleaner. This is largely associated with the absence of buildup of detergent and disinfectant residue on walls, corners, and borders of walls and floors.

Human resources

Cleaning hours have remained constant with no reduction; however, more cleaning is now achieved. Additional areas included on the cleaning schedule that previously had not been addressed include the drug room, cleaning equipment room, daily cleaning of mats at scrub sinks, and additional cleaning of scrub sinks.

Occupational health and safety

There have been no slips, falls, or near-misses since the introduction of the new cleaning method. No allergies, chemical irritation, or musculoskeletal injuries have been reported. Since the introduction of the steam cleaning, there have been no reports of burns.

Table 1
Comparison of costs before and after implementation of the new technology

Cleaning method	Annual cost, $
Traditional cleaning	
Disposable detergent wipes	10,000
Mops	386
Disposal cost of detergent wipes	93
Total cost	10,479
Microfiber and steam cleaning	
Reusable microfiber cloths	200
Mops	184
Reprocessing including water, detergent, electricity, and labor	2,192
Steam machines with 5-y life span	440
Total cost	3,016

Cleaning schedule template

A single cleaning schedule was developed, using several different documents. Initiated in August 2013, the cleaning schedule underwent modifications until all stakeholders were satisfied with the final draft, in February 2014. Equipment and environmental areas are now cleaned following a single cleaning schedule, with cleaning documented on completion.

Operating room budget

Despite the achievement of extended cleaning, the budget for consumables decreased from an annual cost of A$10,093 to A$3,016. Mop handles and buckets were purchased at a cost of $390, and 2 steam cleaners were purchased at $1,100 each, with expected replacement after 5 years. Forty-eight mop heads were purchased for A$11.50 each with expected replacement after 3 years, making the cost $184 per year (Table 1).

A 90% reduction in water use for cleaning was consistent with previously reported data.[1] Ten mops require 1 L of water to provide cleaning for 10 cases. Twenty cloths require 500 mL of water, and each side of the cloth can be used to wipe surfaces. Reusable cloths reduce waste, because they can be recycled into mattress inserts at the end of their cleaning life and do not require disposal after each use. Other savings resulted from eliminating the need to purchase cleaning detergents and disinfectants. Previously, theater mop handles and mop heads were replaced at 6-month intervals at a cost of $386 per year.

Steam and microfiber cleaning reduced the cleaning time in each operating room. This was especially evident when patients, colonized with multidrug-resistant organisms, such as vancomycin-resistant enterococcus, were admitted and discharged. Previously this involved a detergent cleaning followed by a disinfection step, and took 2 hours to complete. Now all discharge cleaning are the same, regardless of the patient's perceived risk.

Deep orthopedic surgical site infection rates for knee and hip joint replacements have remained at previously low levels and have not changed (Fig 1).

DISCUSSION

The implementation of this new cleaning technology is particularly relevant in the context that previous studies have demonstrated that multidrug-resistant organisms can persist on environmental surfaces after routine cleaning.[6] Interventions addressing the thoroughness of cleaning have been successful in

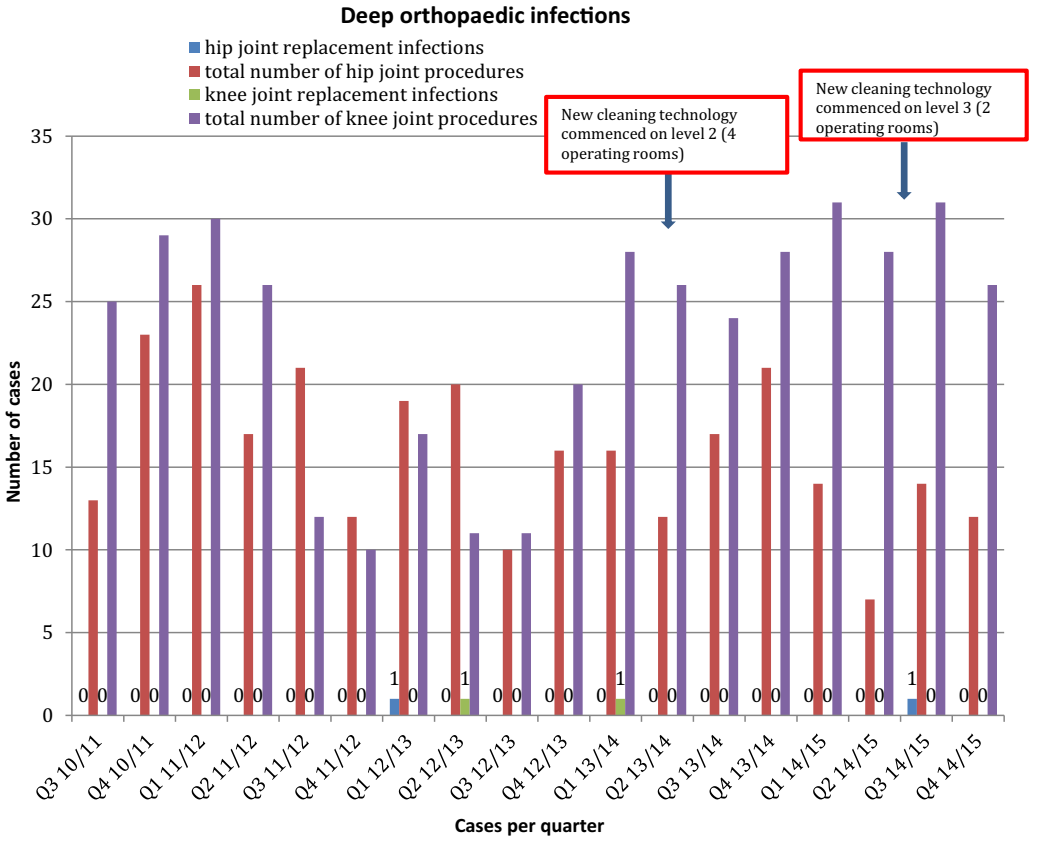

Fig 1. Rates of deep surgical site infection in knee and hip joint replacement.

reducing environmental contamination. Cleaning requires sufficient removal of pathogens to minimize patients' risk of acquiring multidrug-resistant organisms from hospital environments.[7]

Education was key to the successful implementation of this significant project. Initially, clinical staff were not convinced that it would truly work; the fact that the system uses only water was of concern. There were concerns about inhaling the steam used to loosen pathogenic matter and a perceived risk of contracting diseases while cleaning. These concerns were dispelled through consistent and targeted education. The use of settle plates during steam cleaning activities using a control of pathogens helped dispel these concerns.

Increased education and supervision were added to the training schedule of cleaning staff to improve results. Only trained and competent staff were permitted to clean the operating suite. Cleaning staff needed to achieve 80% removal of the fluorescent marker from high-risk points during assessment to be credentialed for cleaning.[8]

Issues involving cloth preparation occurred during the early days of implementation. Containers used to store the cloths leaked. Poor compliance with preparation of cloths and mops with water volumes had to be supported with ongoing supervision and mandatory education.

The introduction of the new technology focused operating room staff on the importance of cleanliness. It also contributed to improved teamwork by promoting involvement in the design of a whole-department cleaning schedule. Significant cooperation was required to achieve this workable document. There is now a reduced risk of slips and falls; moreover, previous gaps in cleaning of the operating suite have been addressed. The time savings achieved with this technology allows for increased cleaning without an increased allocation of staff hours.

In summary, the introduction of microfiber and steam technology into the operating room environment has been environmentally and fiscally beneficial. It has enabled a refocus of available cleaning resources and has produced a safer environment.

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