




Ionad Leigheis Nàiseanta
- a' Ghàidhealtachd

National Treatment
Centre - Highland



Raon-parcaidh

 Car Park



Prìomh dhoras

Main Entrance



Pre-cleaning surgical instruments

A comparative study

Manual and automated pre-cleaning at SSD/ Central
Decontamination Units and Operating Theatres

Author

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Instrument Manager

Liverpool Universities NHS Trust

Current challenges



Manual Pre-clean

Regulations require instruments to be pre-cleaning at point of use (POU).

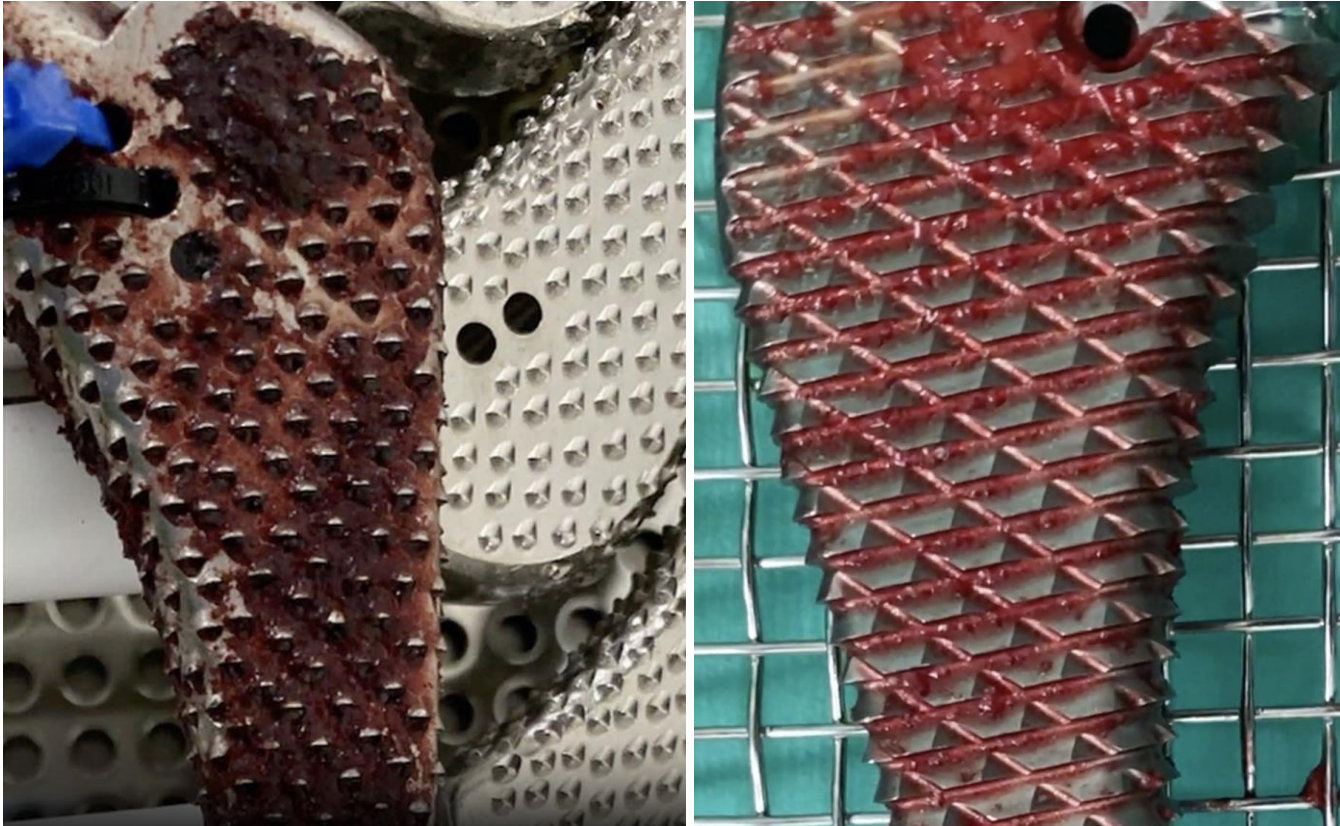
(Instrument IFU's and HTM 01-01)

Manual cleaning at theatre is limited, and in most Theaters non existent due to:

- Staff safety
- Workflow limitations
- Resources required
- Specialist training

“There are not the resources for theatre staff to manually pre-clean”

NTC H Staff Feedback



Current challenges

Efficacy

Pre-cleaning dried on gross contaminates.

- Transportation times to off site Central Decontamination / Sterile Services Depts
- Dried on contaminates require soaking
- Dried on contaminates cause backlogs

“Backlogs are a vicious circle, instruments dry up and are harder to clean”

SSD Technical Manager

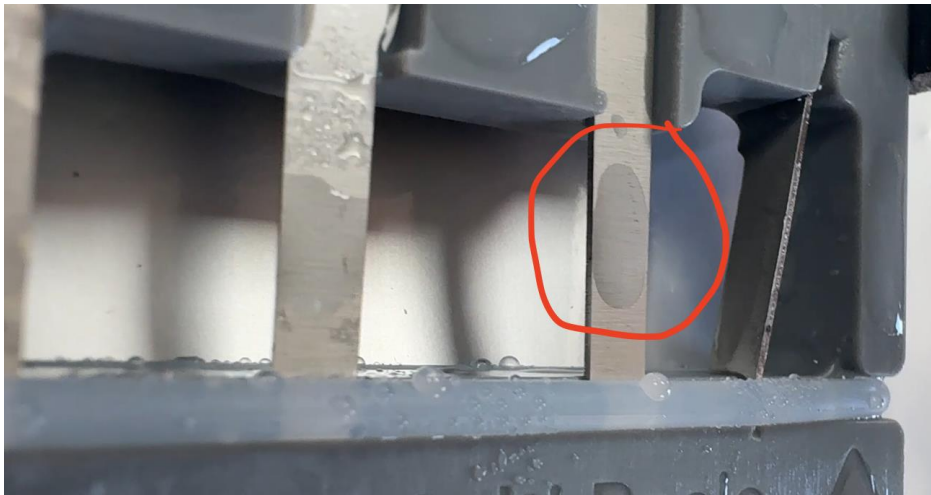
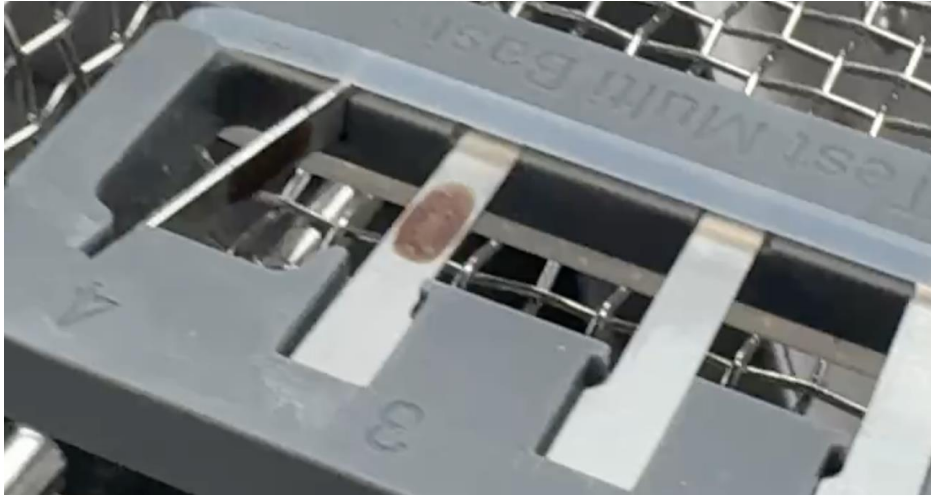


Current challenges

Hydrophobic Proteins

“Some proteins are very hydrophobic and will, once dry, adhere strongly to surfaces and resist removal by swabbing or elution for the purpose of protein detection”

HTM 01-01





Current challenges



Damage

Contaminates damage instruments

- Blood and Saline corrode instruments
- Corrosion breaks through the passivation layer, creates pitting and traps contaminants
- Damaged instruments cause infection

“POU cleaning of surgical instrumentation is a vital component in the prevention of infection and cross-contamination. ”

Tyrone Johnson, CST, CRCST Certified Surgical Technologist



Diverse studies



Pre-cleaning trials at Theatres and
Central Sterile Service Dept

Liverpool

Broadgreen Orthopedic Theaters

and

Sterile Services Dept, Liverpool Universities NHS

Inverness

National Treatment Centre, Orthopedic Theatres
NHS Highland.

and

Raigmore Central Decontamination Unit NHH



Study methodology



Pre-cleaning trials at theatres and central sterile service depts inspect 24,000 instruments

Method

1. Automated validated pre-clean using Tiny Air system
2. 2 minute cold water cycle
3. Inspect
4. If required a further 2 minute cycle.
5. Inspect
6. Record results
7. Distribute staff survey
8. Analyse data

Independent Inspection and Validation

James Bilbao NHS Instrument Manager led the independent inspection and validation of the study.

James Bilbao and supervisors within CDU and SSD's inspected the 24,000 Instruments pre-cleaned during the trial for any visible contamination and recorded the data.



Results

10/02/2025	Joint 1 Tray - N1-L-02	1	light	blood/bone	pass		
10/02/2025	Zimmer Nexgen CR Trial Bearings NTC-13	18	light	blood/bone	pass		
10/02/2025	Major Ortho Part 1-22	18	light	blood	pass		
10/02/2025	Major Ortho Part 2-26	33	light	blood	pass		
10/02/2025	Zimmer Nexgen CR Trial Bearings NTC-09	1	light	blood	pass		
10/02/2025	Zimmer Nexgen Femoral Instruments NTC-01	32	medium	Blood/Bone/oil	pass		
10/02/2025	Zimmer Nexgen Trials & Guides NTC-03	18	light	blood	pass		
10/02/2025	Zimmer Nexgen Tibial Instruments NTC-07	35	light	blood/bone	pass		
10/02/2025	Joint tray NTC-18		16 light	blood	Pass		
10/02/2025	Zimmer Nexgen Femoral Instruments NTC-03		31 light	blood	pass		
11/02/2025	Minor Ortho Part 1-05 008		39 Light	Blood	pass		
11/02/2025	Minor Ortho Part 2-03 008		21 Light	Bone	pass		
11/02/2025	Zimmer Nexgen Trials & Guides ntc-02 023		18 Heavy	Blood/Bone	pass		
11/02/2025	zimmer Nexgen cr trial bearings NTC-01 029		18 Light	Blood	pass		
11/02/2025	Zimmer Nexgen Femoral Instruments NTC-07 020		32 Light	Blood	pass		
11/02/2025	Major Ortho Part 1-13 007		18 Light	Blood	pass		
11/02/2025	Major Ortho Part 2-14. 007		31 Medium	Blood	Fail/NA	pass	Historical blood found
11/02/2025	Joint Tray - NTC-08 006		17 Light	Blood	pass		
11/02/2025	Zimmer Nexgen Tibial Instruments NTC-04 019		35 Medium	Blood/Bone	pass		
11/02/2005	Minor Ortho part 2-05 008		21 Light	Blood	pass		
11/02/2025	RA ANCHORAGE NTC-03 046		43 Medium	Bone	pass		
11/02/2025	Minor Ortho Part 1-01 008		38 Light	Blood	pass		Historical blood found
11/02/2025	Exeter Rasp 37.5 & 44 No 4-02 INP19463		2 Heavy	Blood/Bone	pass		
11/02/2025	Exeter Rasp Tray NTC-12 071		27 Heavy	Blood/Bone	pass		
11/02/2025	RA Trident General Instruments NTC-01 068		31 Medium	Blood	Fail	pass	Historical debris/blood
11/02/2025	Trident reamers 38mm to 66mm NTC-06 070		33 Heavy	Blood/Bone	Fail	pass	
11/02/2025	Exeter Outside Rasps NTC-04 069		15 Heavy	Blood/Bone	fail	pass	
11/02/2025	Exeter Femoral 1 of 2 NTC-11 072		12 Heavy	Blood/Bone	fail	pass	Debris still in box chisel
11/02/2025	Chamley Frame and blades-09 003		8 Heavy	Blood	pass		
11/02/2025	Joint Tray NTC-22 006		17 Heavy	Blood/Bone	Fail	pass	Blood/bone still in nibbler jaws
11/02/2025	Exeter Femoral 2 of 2 NTC-11 073		11 LIGHT	Blood	pass		
11/02/2025	Monir Ortho Part 1-08		39 Light	Blood	pass		
11/02/2025	RA Anchorage NTC-01 046		44 Light	Bone	pass		
11/02/2025	Minor Ortho Part 1-06 008		39 Light	Blood/Bone	pass		
12/02/2025	Major Ortho Part 2-03 007		33 Medium	Blood	N/A		Debris still in situ on forceps teeth. H
12/02/2025	Major Ortho Part 1-26 007		18 Medium	Blood	pass		
12/02/2025	Zimmer M/L Taper		10 Heavy	Blood/Bone	pass		
12/02/2012	Joint Tray - NTC-19		17 Medium	Blood	pass		
12/02/2025	Zimmer Continium Tray 3 of 3-05		22 Light	Blood	pass		
12/02/2012	Zimmer Continium Tray 1 of 3 -04		40 heavy	Blood/Bone	pass		
12/02/2025	chamley Frame and blades-04 003		8 Heavy	Blood	pass		
12/02/2025	Zimmer Taper M/L Taper 1 of 2-02		36 Heavy	Blood/Bone	pass		
12/02/2025	Zimmer Continium Tray 2 OF 3-04 082		19 Light	Blood	pass		

Removing all visible contamination

Gold Standard Test

The trial tested:

- each instrument for visible contamination
- if no visible contamination found record a pass
- if any contamination was found they are to be reprocessed again through Tiny Air
- if instruments failed after 2 cycles they were marked as failed
- cured adhesives were excluded from the study

Defined standard



The trial set out to collect data that examined the difference between Theatre and SSD pre-cleaning, controlled for all other variables and with a large sample size to ensure accuracy.



Results

Percentage Improvement of Theatre over SSD

Category	Improvement	

2 min Tiny Air Cycle Theatre:		13.4%
Follow up additional 2 min Tiny Air Cycle Theatre:		4.2%

Analysis of the data confirms that it is easier to remove contamination at point of use.

Independent Inspection and Validation

Raigmore CDU and NTCH results

400 Sets of instruments averaging 30 instruments/set. If a single instrument in the set had any contamination remaining the entire set failed.

- 2 min Tiny Air Cycle SSD 82%
- 2 min Tiny Air Cycle Theatre 92.8%
- 4 min Tiny Air Cycle SSD 96%
- 4 min Tiny Air Cycle Theatre 100%

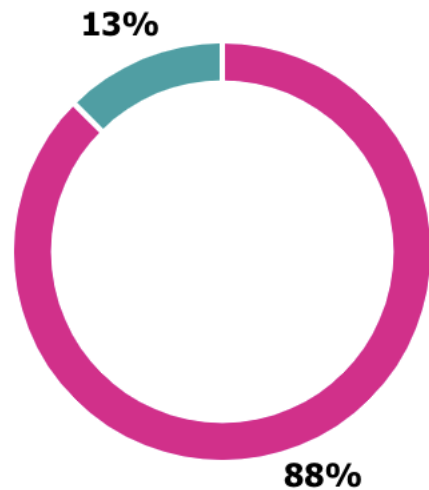


Key figures

Independent Inspection and Validation

Raigmore CDU and NTC-H results

- NTC-H Average 400 Ortho sets / week (12,000 Instruments)
- Would require 4 full time staff to manually pre-clean.
- Manual pre-clean would require 230,400 litres of warm water, 1344 litres of detergent (£14,400/ annum) to manually pre-clean the NTC-H Ortho Sets
- Raigmore CDU uses approx £90,000 of detergent/ annum to manually pre-clean
- Tiny Air would require 1 staff member and no chemicals to pre-clean NTC Ortho sets.
- Tiny Air reduces CO2 emissions by 70% compared to manual pre-clean
- Tiny Air increases capacity of CDU's by 10%
- Tiny Air reduces rewash rates by an average of 40%



- Theatre Staff
- dedicated CDU Staff
- both theatre and dedicated CDU Staff
- none of the above

Survey

What do staff at theatres think?

Who should be pre-cleaning?

Is manual pre-cleaning, effective, a burden, dangerous or even possible?

Does automated pre-cleaning provide the solution?

If automated pre-cleaning at theatre is a solution what challenges are there?

Full survey results in which all relevant theatre staff answered 30 questions is available separately.



Obstacles to overcome

Challenges for automated pre-cleaning at Theatre



- Available suitable space
- Movement of instrument sets and infection control
- Automated system may require a blade dryer upgrade for Theatre to remove excess water for transportation
- Involvement of CDU/SSD dept
- Secondment of CDU/ SSD staff
- Changes to culture and current practices
- Strategic policy



Survey results

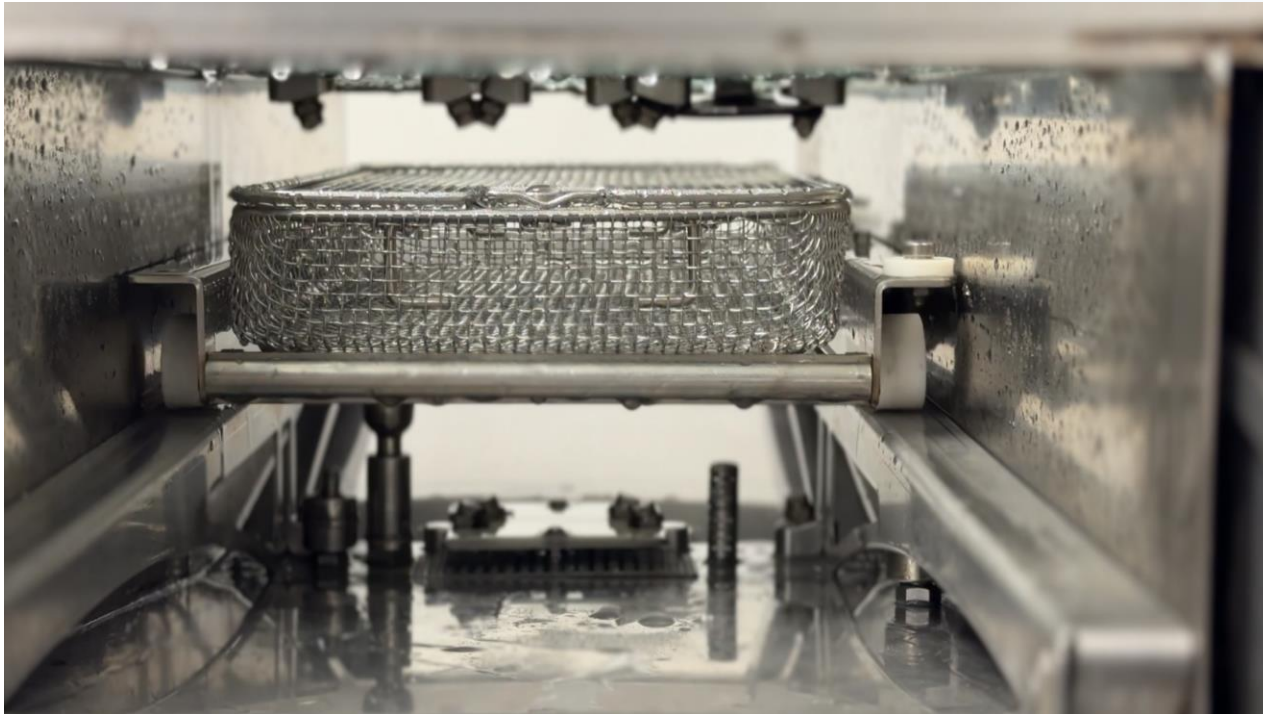


Key findings

- Manual pre-cleaning to meet IFU and HTM 01-01 regulations at theatre is not possible.
- Tiny Air automated pre-cleaning at Theatre does provide a solution that solves key problems.
- Automated pre-cleaning at Theatre needs to be carried out by CDU/ SSD Staff
- Automated Pre-cleaning at Theatre is easier, quicker and more effective than at CDU/SSD
- Automated Pre-cleaning at theatre would save resources, reduce chemical and energy use, reduce CO2, improve working condition and safety for staff.
- Automated pre-cleaning at theater would reduce damage to instruments through corrosion and reduce surgical site infections.
- Pre-cleaning at POU/Theatre is vital.



Recommendations



Suggested Actions

- Pre-cleaning at POU/Theatre is essential, it is advised that the potential automated solution be presented to relevant strategic management within the NHS and government.
- A roll out of automated pre-cleaning at Theatre should be implemented by Sterile Services.
- The Sterile Services/ CDU staff should operate the automated system at the Operating Theatre.