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Storage environment of surgical instruments before reprocessing

Part of the RSME Research Program

Karin Bundgaard
Associate professor, PhD, MScN, RN
Clinic for Neuro-, Head and Orthopaedic Diseases & Clinical Nursing Research Unit
Aalborg University Hospital, Denmark
Department of Clinical Medicine, Aalborg University, Denmark

Storage environment before reprocessing

Background

- Reprocessing of surgical instruments must commence as soon as possible post-surgery
- Transport and storage occur in a humid environment until reprocessing is commenced

(Instrument Preparation Working Group 2018, NIR 2019)

Why

- The primary concern is the risk of corrosion and thereby destruction of the instrument
- Drying times beyond 15 minutes reduces the effect of subsequent cleaning

(Lipscomb et al. 2007, Secker et al. 2011, Secker et al. 2015)

Storage environment before reprocessing

Aim

To test if a humid environment for storing surgical instruments until reprocessing reduces the occurrence of corrosion, as well as the occurrence and accumulation of biological material compared to instruments stored in a dry environment

HYPOTHESIS

Storage environment before reprocessing

Methods

Instruments:

- Forceps and irrigation syringes

Contamination:

- Human EDTA blood amended with *Enterococcus faecalis* ATCC 29212 (final concentration: $1.5*10^8$ CFU/mL)

Washing, disinfection and sterilization:

- The washer-disinfector and autoclave using standard protocols for the CDS at Aalborg University Hospital, Denmark

Storage environment before reprocessing

Protein residue

- 108 forceps & 108 syringes
- Contaminated before each reprocessing cycle
- Stored for 6, 12 or 24 hours in dry or humid environments
- 1, 25 or 50 reprocessing cycles
- Analysis: OPA-method

Corrosion

- 108 forceps
- Contaminated before each reprocessing cycle
- Stored for 6, 12 or 24 hours in dry or humid environments
- 1, 25 or 50 reprocessing cycles
- Analysis: Stereomicroscopy, scanning electron microscopy (SEM), and energy dispersive spectroscopy (EDS)

Storage environment before reprocessing

Defining storage environment

Dry

- Storage in open transport boxes without cover

Humid

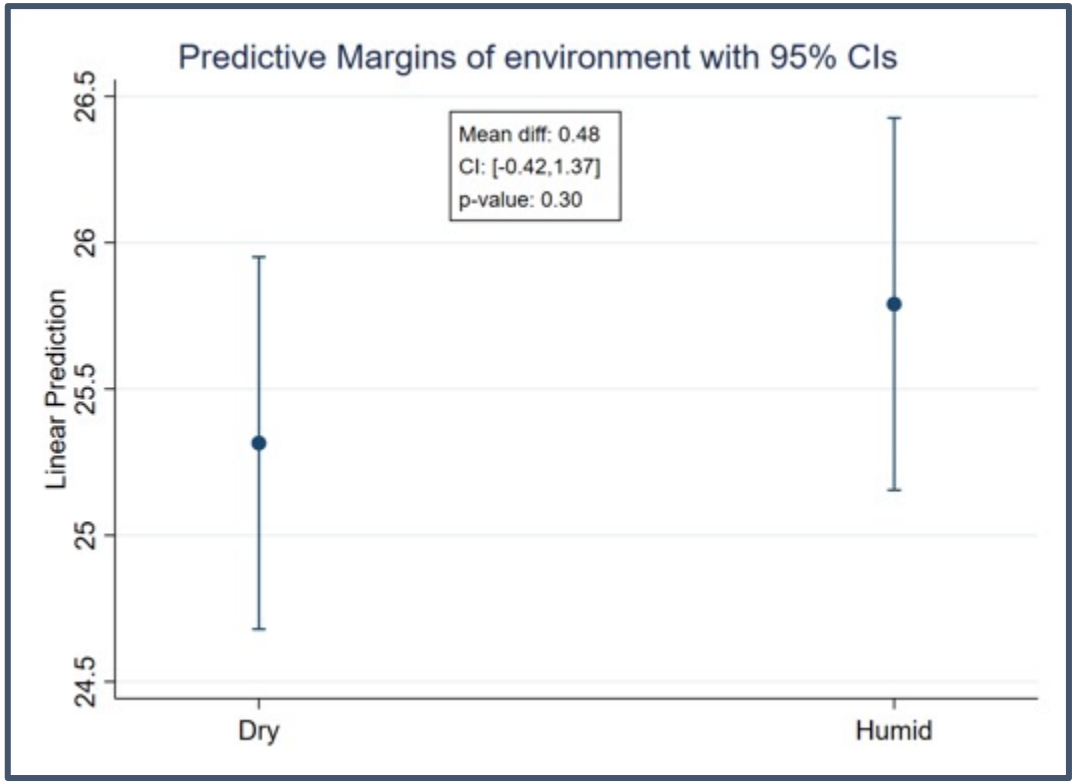
- Storage in closed transport box covered in the same amount of cotton gauze wetted with the same amount of sterile water

Storage environment before reprocessing

Results

Protein residue

- Forceps ranged from 21.8 to 28.1 µg (mean: 24.4 µg, sd: 1.3 µg)
- Syringes ranged from 21.5 to 54.0 µg (mean: 26.7 µg, sd: 4.9 µg)
- Negative control (mean: 24.5 µg, sd: 1.8 µg)



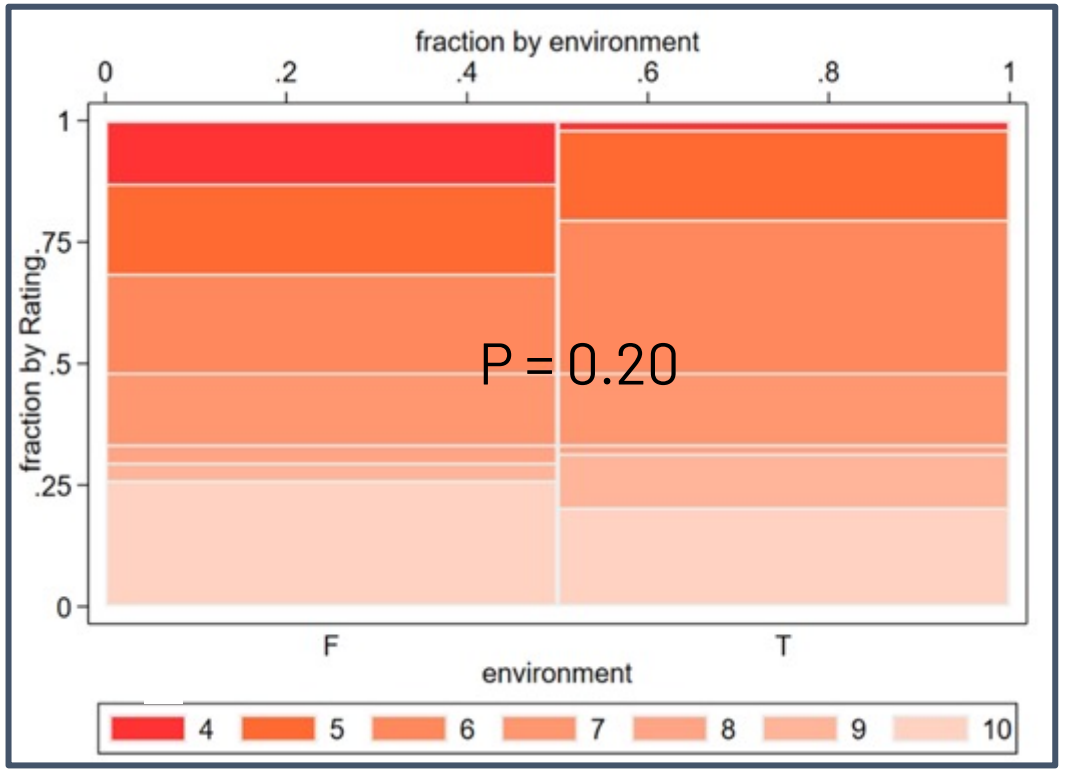
Storage environment before reprocessing

Results

Area of corrosion, A [%]	Rating, Rp [-]
No defects*	10
0 < A ≤ 0,1	9
0,1 < A ≤ 0,25	8
0,25 < A ≤ 0,5	7
0,5 < A ≤ 1,0	6
1,0 < A ≤ 2,5	5
2,5 < A ≤ 5,0	4
5,0 < A ≤ 10	3
10 < A ≤ 25	2
25 < A ≤ 50	1
50 < A	0

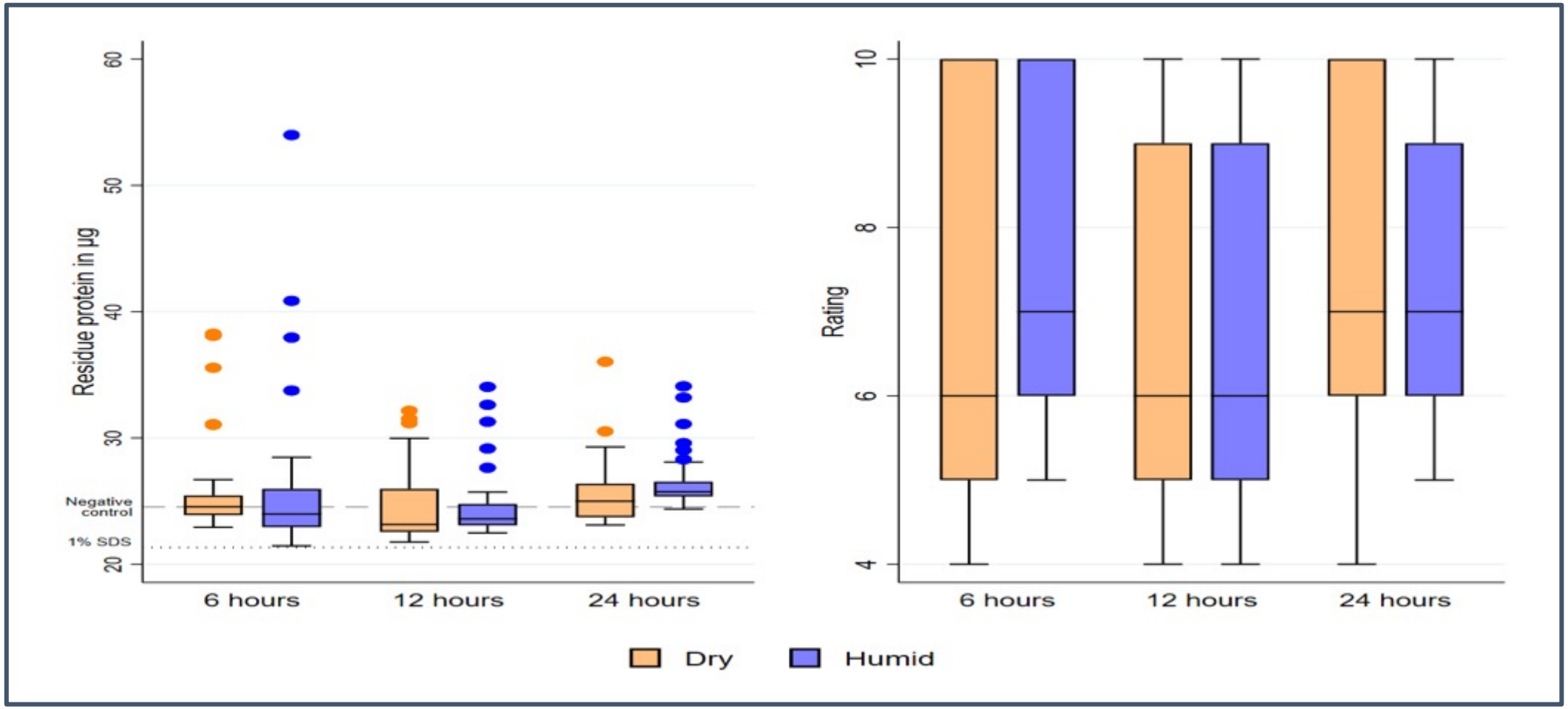
Corrosion

- 1 cycle: None to 0.25% (mean 0.06%)
- 25 cycles: 0.25 and 5.0% (mean 0.52%)
- 50 cycles: 0.25 and 5.0% (mean 1.45%)



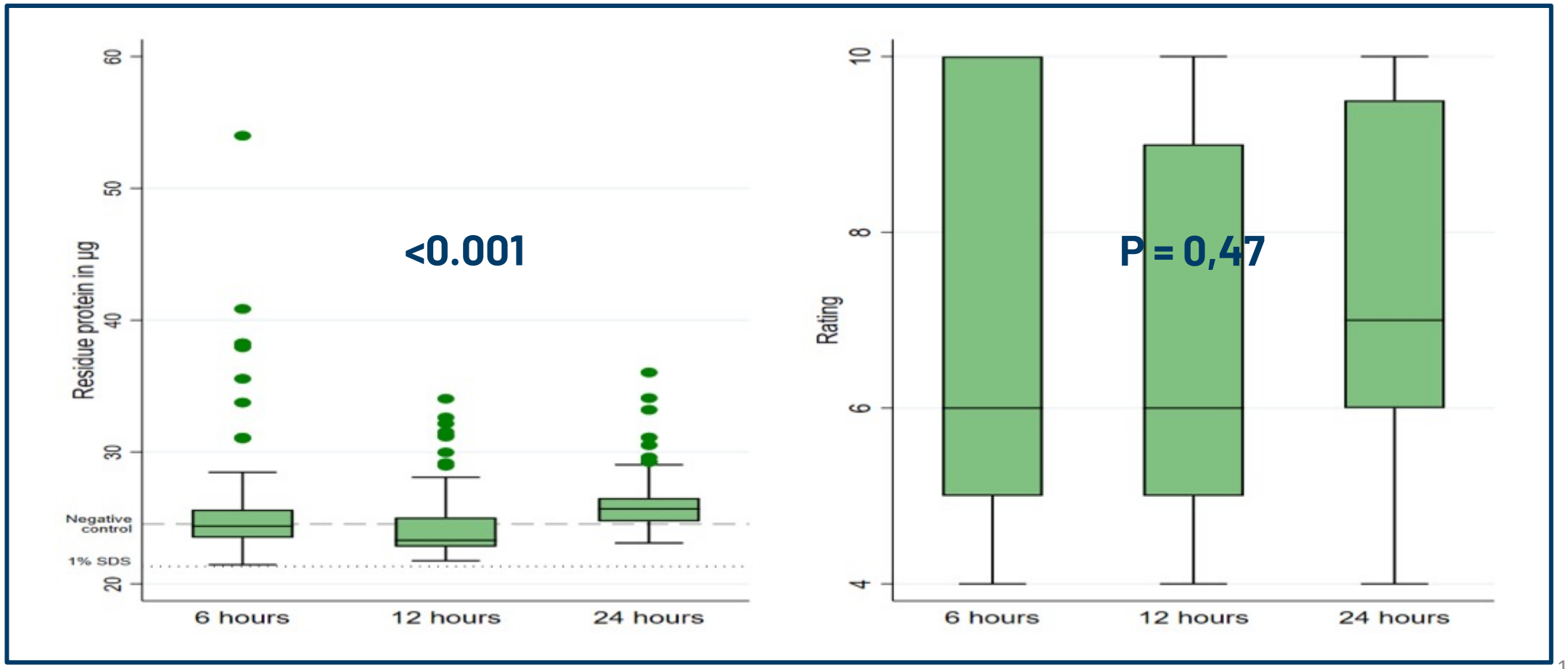
Storage environment before reprocessing

Holding time adjusted for storage



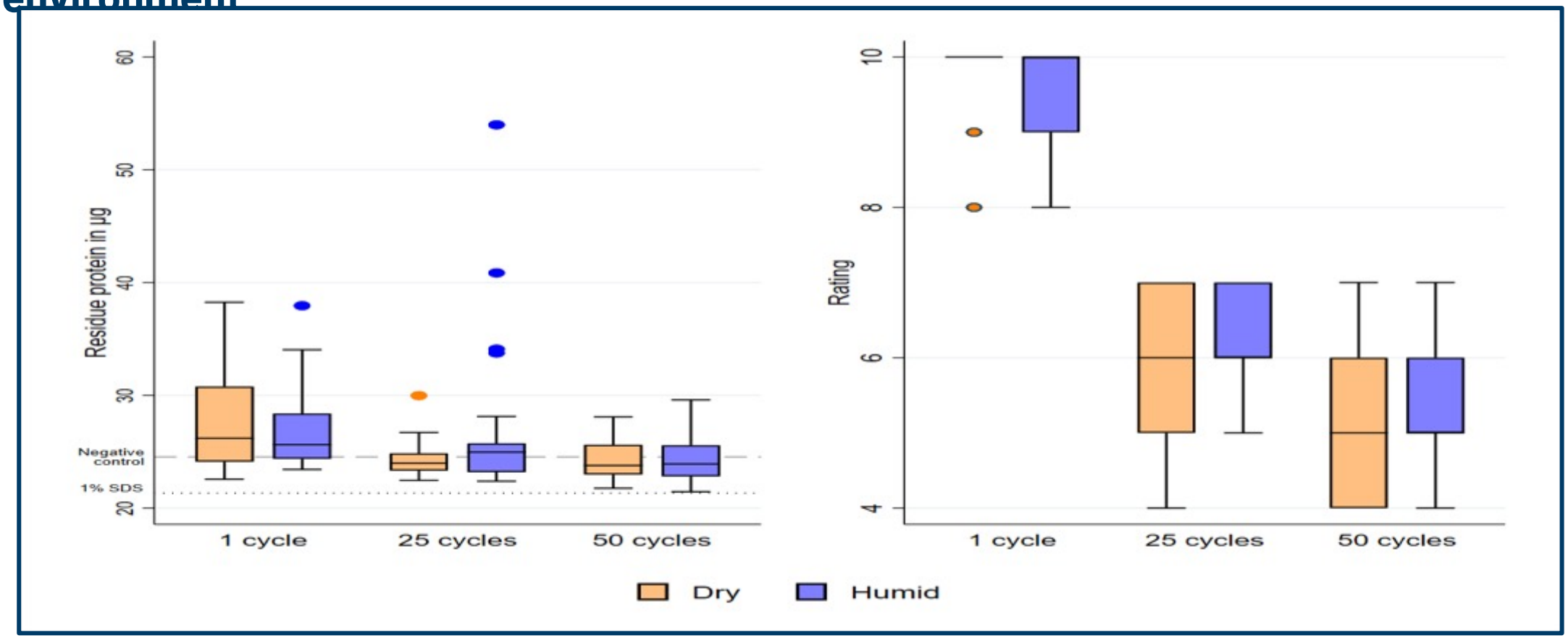
Storage environment before reprocessing

Holding time



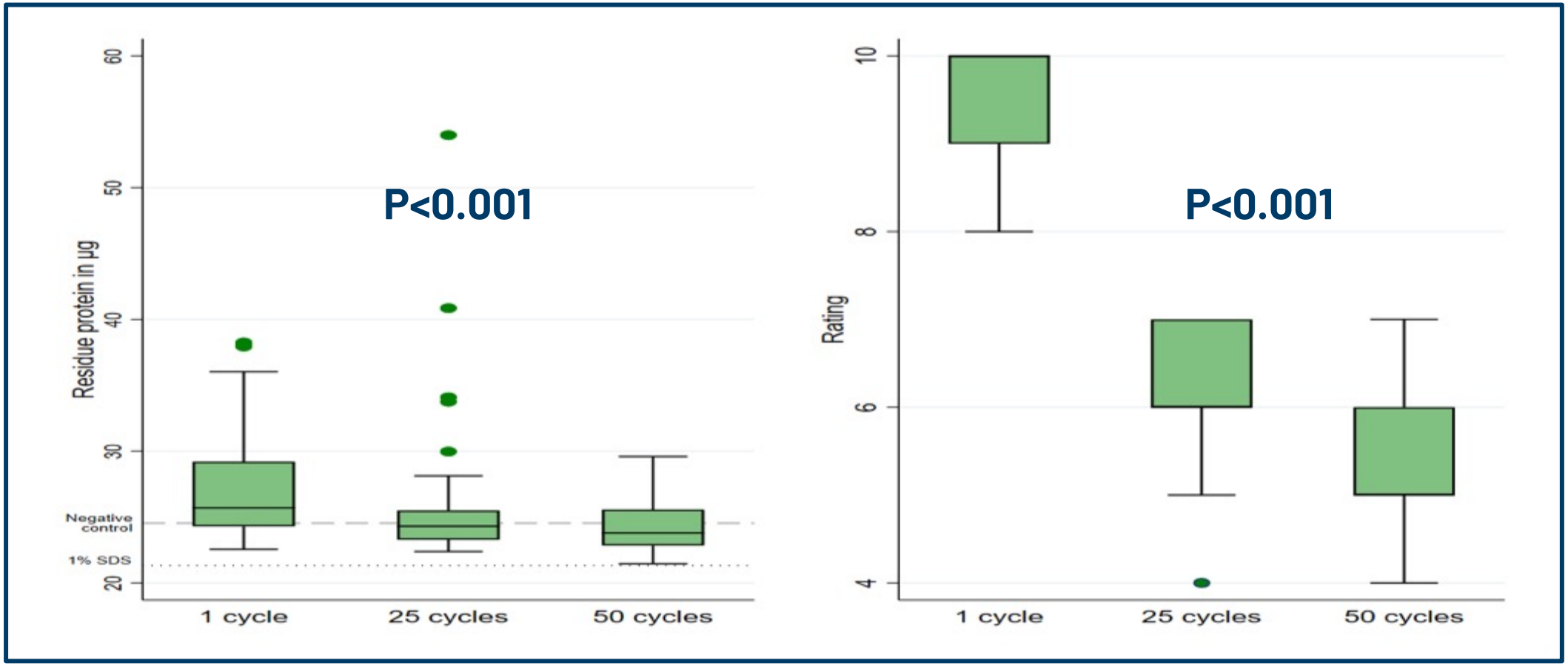
Storage environment before reprocessing

Number of cycles adjusted for storage environment

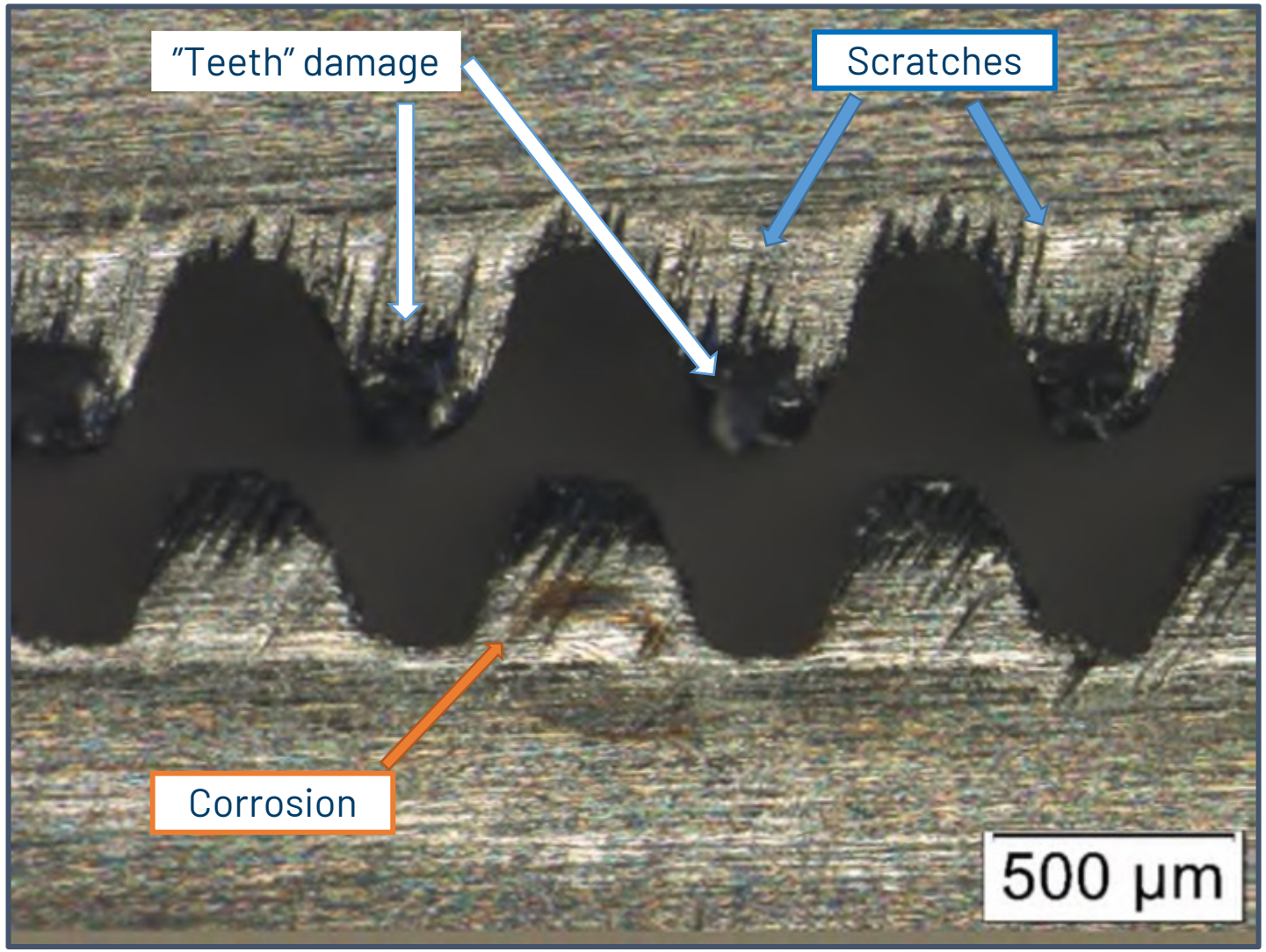


Storage environment before reprocessing

Number of



Storage environment before reprocessing



- Defects were observed on all inspected instruments
- Pitting corrosion in random areas
- EDS revealed particles consisting of silicon, calcium and aluminum
- Not caused by corrosion but likely due to the metal composition of the instruments

Storage environment before reprocessing

Conclusion

Cleanliness and durability of instruments seems not to be affected by storage environment but instead by number of treatment cycles

Patient safety seems not to be compromised by storage environment; however, it is unknown if corrosion residue are transferred from the instruments to the patient and which amount of corrosion may have a damaging effect

Storage environment before reprocessing

Strength and limitations

- Choice of instruments: Commonly used instruments for surgery
- Choice of soiling: Human EDTA blood and a common hospital bacteria strain known for its adhesiveness
- Standardized environments
- Reprocessing: Standard protocols for washing, disinfection and sterilization
- Handling of reprocessing: Trained personnel from the CDS
- Protein residue analysis: Performed by professionals – OPA method
- Corrosion analysis: Performed by professionals – provides quantification

- Choice of soiling
- Choice of method of creating a humid environment
- Choice of instruments
- …

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Research group

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- Jan Lorenzen, Product Manager Biotechnology, PhD, Danish Technological Institute, Denmark
- Krister Ripadal, CSSD manager, MScPH, Aalborg University Hospital, Denmark
- Ann-Eva Christensen, Biostatistician, PhD, Aalborg University Hospital, Denmark
- Dorthe Aaen, Specially trained hygiene nurse, MPH, Aalborg University Hospital, Denmark
- Hans Linde Nielsen, Chief Physician, PhD, Clinical Ass. Professor, Aalborg University & Aalborg University Hospital, Denmark
- Karin Bundgaard, Ass. Professor, PhD, MScN, RN, Aalborg University & Aalborg University Hospital, Denmark

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Storage environment before reprocessing

Influence Factors of Dispoal Results

Process Goals:
- Instruments clean (different limits)
- Free of stains and corrosion (Value preservation, Inspection)

Multiple Influence Factors
- Can not be fully simulated in laboratory
- No process has perfect results

Comparative clinical trials necessary
⇒ Recommendations for daily practice (depending on circumstances)

Study Groups will cooperate !

Surgery:
- Types of soil
- Degree of soiling
- Intermediate cleaning
- Geometry of devices

Point-of-Use Cleaning:
- Way of cleaning (immersion, wiping,…)
- Media (Water, Saline,…)
- Chemistry

Transportation
- Moist / Dry /….
- Time
- Temperature, humidity,..

Repeated
- Accumulation
- Long term Results

Manual Pre- Cleaning:
- Way of cleaning (Brush, Ultrasound,…)
- Media (Water, Saline,…)
- Chemistry

Inspection

Machine Cleaning
- Parameters
- Media (Water, Saline,…)
- Chemistry