



# 23<sup>RD</sup> WORLD STERILIZATION CONGRESS

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## BARCELONA



## *Contamination and surface damage on reprocessed robotic system surgical instruments in clinical use*



### PRELIMINARY STUDY

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No conflict of interest.

## Robot-assisted surgery

- Increasingly available
- Various specialties
- Minimally invasive
- Meticulous handling of tissues/organs



both 2013; Wehrl, Michels 2013; Wehrl et al., 2014; Saito et al. 2016; Wehrl 2017; Sagourin et al., 2021)

## Robot-assisted surgery

Image - authors

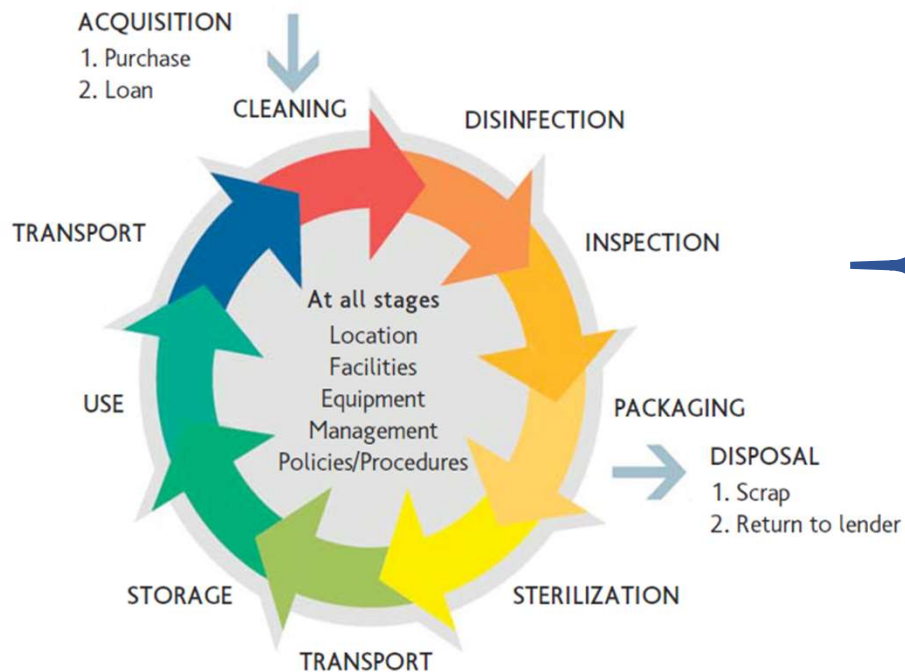


**REUSABLE**  
**surgical**  
**instruments**

# Background

**REUSABLE surgical  
instruments**

**REPROCESSING**

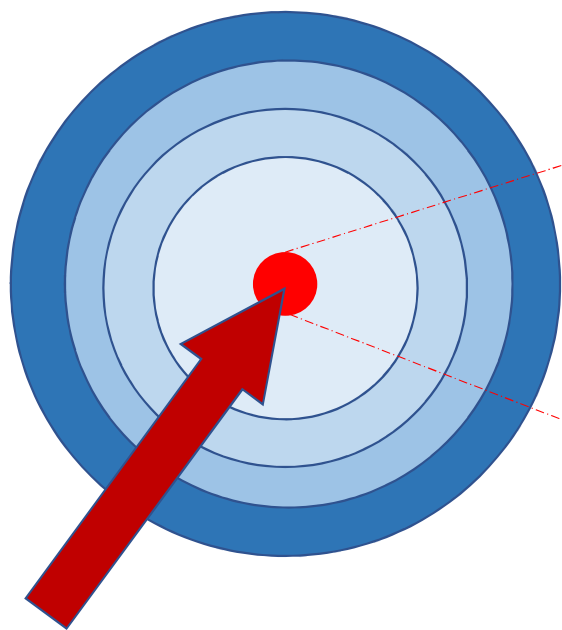


**RSSI reprocessing → CHALLENGE**

- Small-sized
- Geometrical complexity = Complex design
- Not disassembled
- Hidden areas
- Many reprocessing steps
- Many manual steps, – human dependency

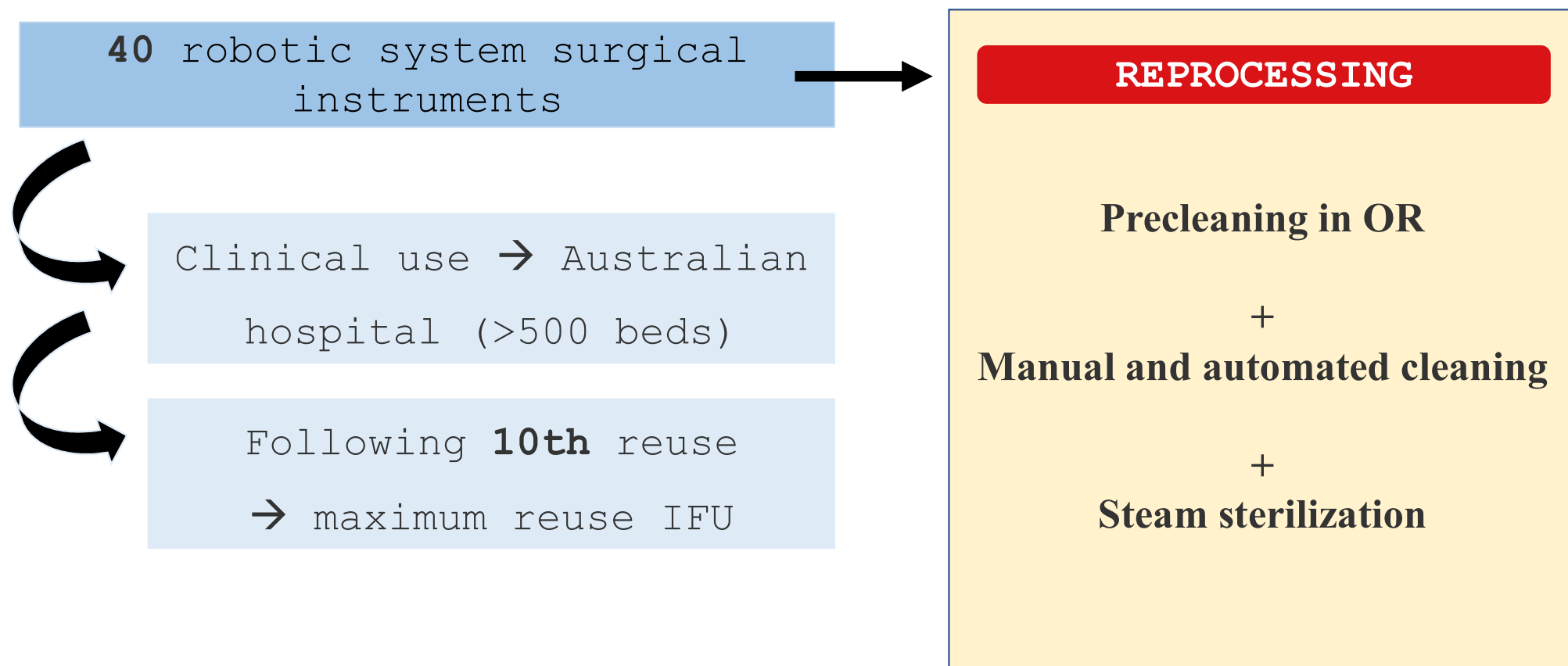
(Michels, Roth 2013; Wehrl, Michels 2013; Wehrl et al., 2014; Saito et al. 2016; Wehrl 2017; Saito et al., 2021)

## Aim



### **RSSI reprocessing → CHALLENGE**

→ To assess the cleanliness and surface condition of Robotic System Surgical Instruments (RSSI) in clinical use.





10th reuse  
+ full  
reprocessing

Distal  
working end  
(Destructive

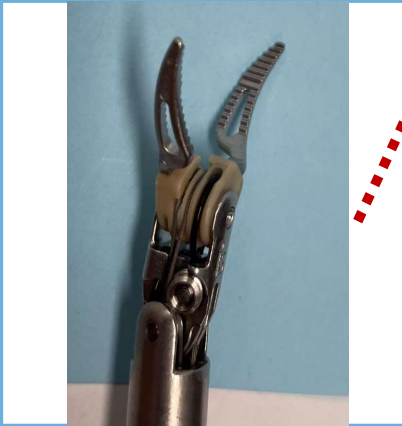


Image - authors

## Optical microscopy (Stereomicroscope System SZX16, Olympus)

**Amount of  
debris**

- Scanning Electron Microscopy (JSM-  
6400, JOEL)

- Protein test (Pierce BCA Protein Assay,  
Alkaline hydrolysis (Li et al., 2006;  
Themofisher) Chowdhury et al., 2019)

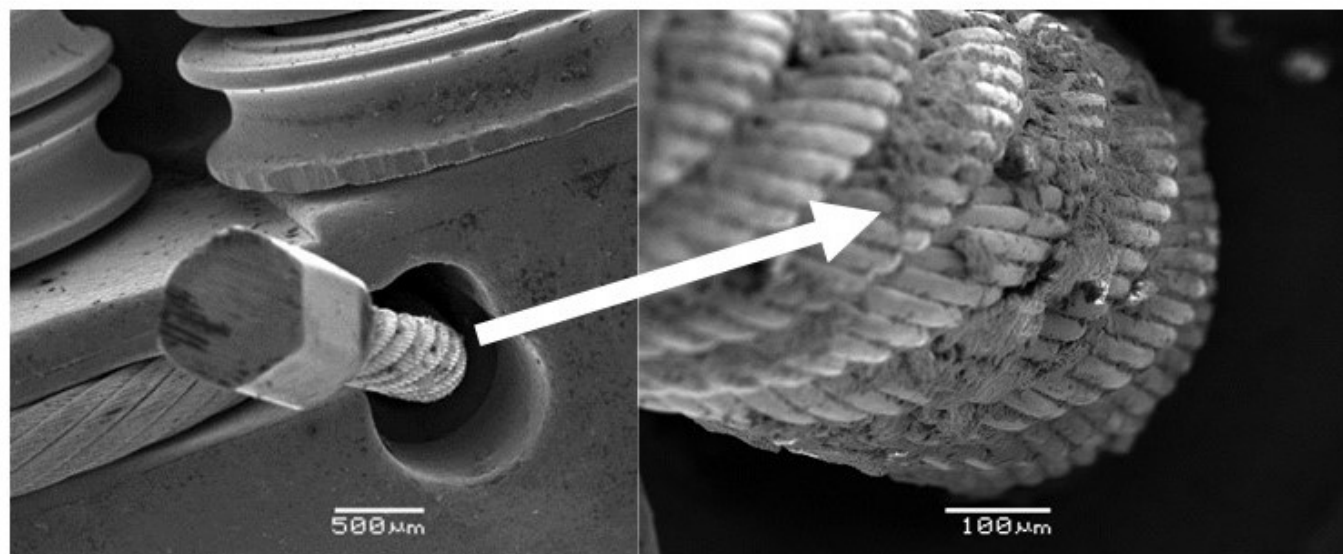
Distal working end → **27cm<sup>2</sup>** (Wehrli;  
Michels, 2013)

- Corrosion test (Potassium ferricyanide  
III, Sigma)



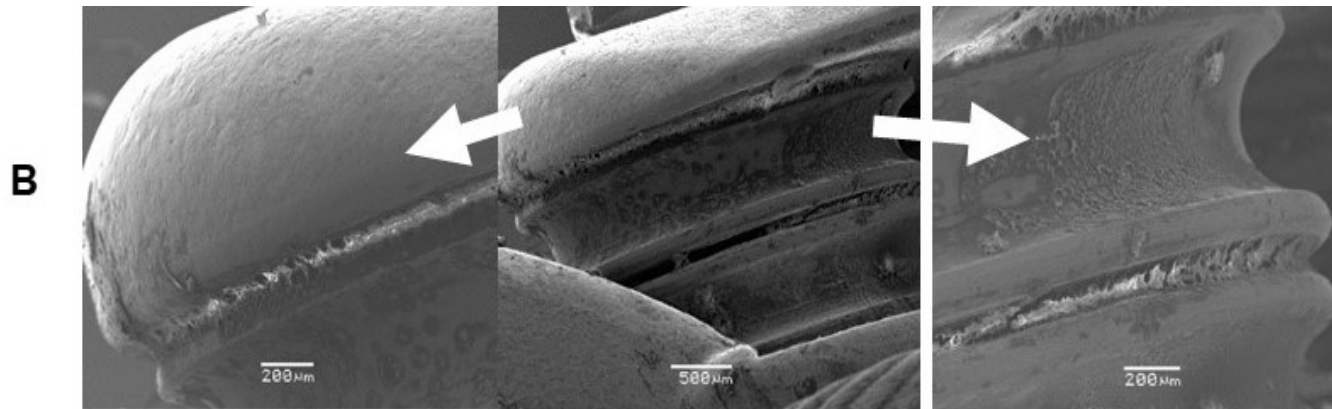
Monopolar Curved  
Scissors  
→ Joint cable

A



**Figure 1.** Scanning electron microscopy images of robotic system surgical instruments in clinical use after reprocessing. A - Debris on the wire of a surgical instrument joint.

Monopolar  
Curved Scissors  
→ Pulley after  
cables removed

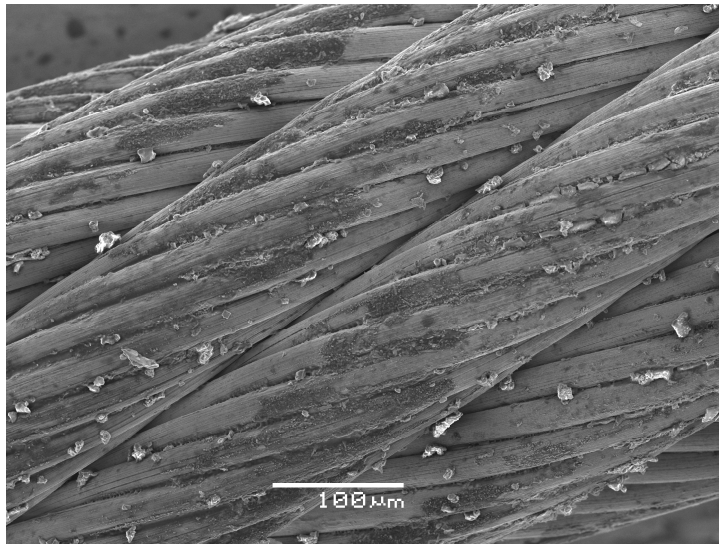


**Figure 1.** Scanning electron microscopy images of robotic system surgical instruments in clinical use after reprocessing.

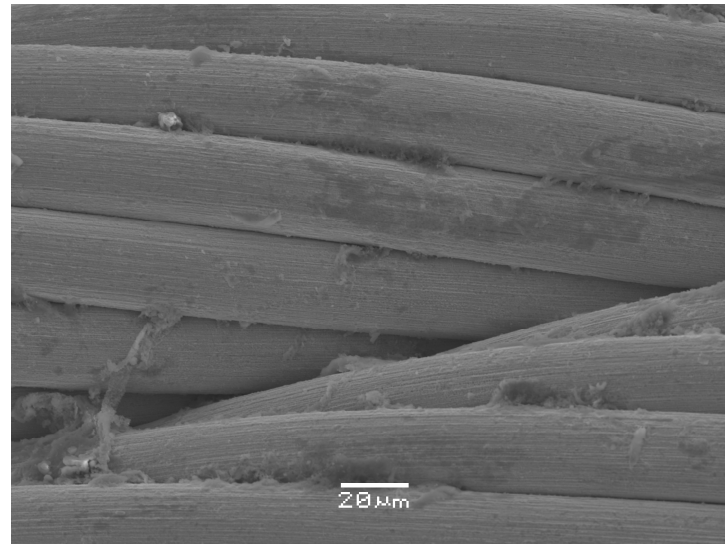
B – Debris on the pulley of a surgical instrument joint.

# Results → SEM

Monopolar  
Curved  
Scissors



Large  
Needle  
Driver



Joint cables/wires

# Results → protein

- Residual protein on all samples
- Average 33  $\mu\text{g}/\text{cm}^2$  (range 6  $\mu\text{g}/\text{cm}^2$  to 55  $\mu\text{g}/\text{cm}^2$ )



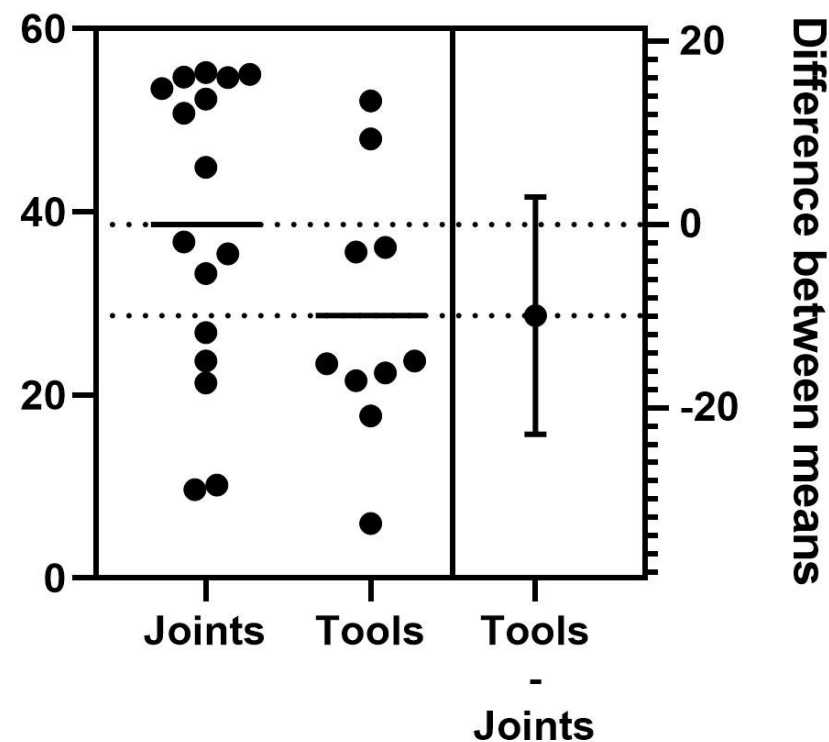
Recommended benchmark

**10-fold** → “alert level”  $\geq 3 \mu\text{g}/\text{cm}^2$   
**5-fold** → “action level”  $\geq 6.4 \mu\text{g}/\text{cm}^2$

(BS EN ISO 15883-5:2021)

**Remaining organic matter!**

**Estimation Plot**



## Results → protein

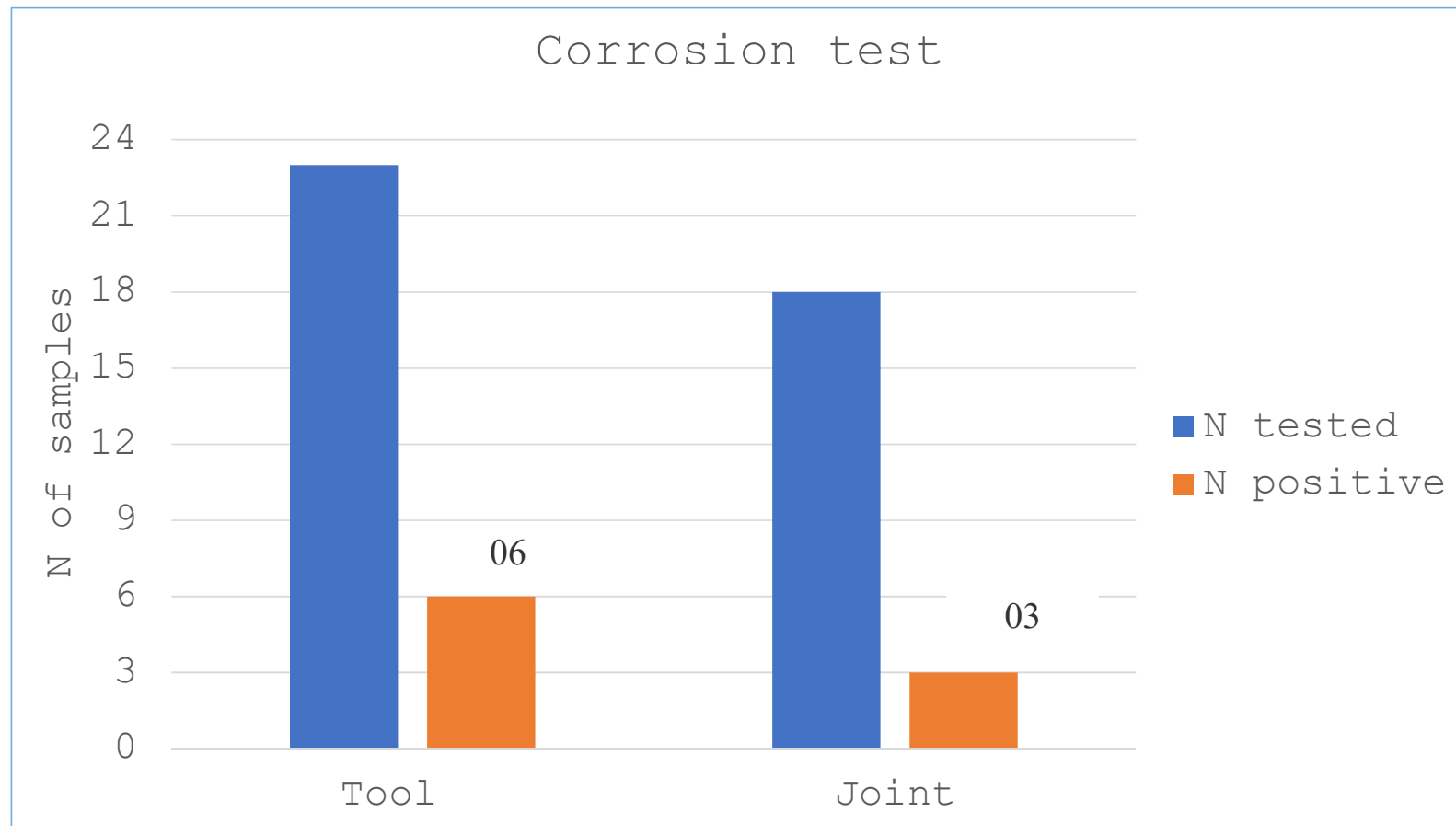
### Protein detection on Robotic System Surgical Instruments - RSSI in clinical use and after 10 reuses

- **Saito et al. 2016** → smaller amount 410 µg/instrument →  
working end + 5µg/side instrument (HTM, UK, 2016)



- **Sagourin et al.** "action level"  $\geq 6.4\mu\text{g}/\text{cm}^2$  (BS EN ISO 15883-5:2021) activity

# Results → corrosion



# Conclusion

→ Robotic System Surgical Instruments (RSSI) in clinical use (10th) contaminated with **organic matter** (protein) + **surface damage** (corrosion).

- Benefits of robot-assisted surgery must include safely reprocessable instrument to avoid adverse effects to patient → designed for use and reprocessing
- Quality/safety device reprocessed/reused multiple times = reprocessed/used once or provided sterile

→ Assess reuse/reprocessing of RSSI (small and inaccessible to brush areas) → cleanability # CSSD scenarios + new technology + alternatives

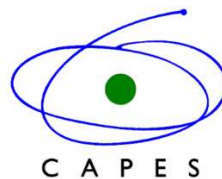
→ RSSI provision as sterile/single-use



# Limitations

- End of useful life of instruments only
  - Distal working end only – not shaft
  - No interference in the reprocessing routine of the hospital
  - Individual area of instrument type not measured
- Result and limitations of this preliminary study
- Take into account for further studies

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*Gracias*  
*thank you*  
*obrigada*

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