



Pseudomonas aeruginosa Adherence to Human Soiled Silicone Hydrogel Lenses



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Purpose

- Silicone hydrogel (SiH) contact lenses (CL) have reduced the hypoxic complications associated with continuous wear (CW)¹; however, CW remains a major risk factor for the development of microbial keratitis (MK).²⁻⁴
- *P. aeruginosa* continues to be the most common pathogen in corneal infection of SiH CL wearers.⁵ Two different genotypes of *P. aeruginosa* have been identified from corneal infections; acutely cytotoxic strains can kill epithelial cells within 3 h of exposure, & invasive strains that can enter epithelial cells & lack acute cytotoxic activity.⁶
- Adverse response rates vary significantly between SiH CL types when worn on a CW basis.⁷
- The aim of this study was to investigate the effect of *P. aeruginosa* phenotype, CL material & CL soiling on adhesion of *P. aeruginosa* to CLs.

Methods

- 2 *P. aeruginosa* MK isolates, one invasive strain (6294) & one cytotoxic strain (6206), were used for primary adherence assays.
- 3 types of SiH CL materials were assessed; surface coated - lotrafilcon A (LotA), surface treated - balafilcon A (BalA) & uncoated/untreated - comfilcon A (ComA).
- Worn (W) SiH CLs were collected from 25 subjects. All subject wore a ComA CL in one eye (n=25) & either BalA (n=13) or LotA (n=12) in the other eye. In addition, pre-soaked unworn (U) CLs (n=50) were assessed.
- CLs were incubated in 2×10^8 CFU/ml of inoculum at 37°C for 2 h, washed 5 times in 0.9% saline & either vortexed (2,500 rpm for 5 mins) or homogenized in 2 ml saline.
- The number of adherent bacteria were determined by triplicate viable counts.
- Statistical analysis: comparisons were made using repeated measures (lens pairs) or one-way (phenotype) ANOVA with Bonferroni post-hoc tests. $p < 0.05$ was considered to be statistically significant.

Results

- The invasive *P. aeruginosa* strain showed significantly greater adherence to all W (soiled) & U CL types compared to the cytotoxic strain ($p < 0.05$, Figure 1).
- There was significantly lower adherence to U uncoated/untreated CLs (ComA) compared to U surface treated (BalA) or U surface coated (LotA) CLs for both invasive (Figure 2) & cytotoxic (Figure 3) *P. aeruginosa* strains ($p < 0.05$).
- Both the invasive (Figure 2) & cytotoxic (Figure 3) *P. aeruginosa* strains showed greater adherence to the U surface coated (LotA) CLs compared to W LotA CLs ($p < 0.05$).
- There were no significant differences in adherence of either *P. aeruginosa* strain to U or W uncoated/untreated (ComA) CLs.
- For the surface treated (BalA) CLs, the invasive *P. aeruginosa* strain showed significantly greater adherence to U CLs (Figure 2, $p < 0.05$), whereas the cytotoxic strain showed significantly greater adherence to W CLs (Figure 3, $p < 0.05$).

Conclusions

- *P. aeruginosa* phenotype, CL material & soil levels all interact to influence bacterial adherence to SiH CLs.
- A *P. aeruginosa* invasive strain showed greater adherence than a cytotoxic strain to all SiH materials.
- Both CL material & soiling are also significant factors in the adherence of *P. aeruginosa* to SiH CLs. However, the effect of soiling on adherence varies with CL material, possibly due to differences in surface characteristics, & bacterial phenotype.
- It is generally accepted that CLs with a decreased affinity for bacterial adherence will reduce the risk of CLs facilitating infection.⁸ Further studies using additional *P. aeruginosa* strains & other microorganisms such as *Serratia marcescens* & *Staphylococcus aureus* are warranted to improve our understanding of factors contributing to bacterial adherence to SiH CLs.

References

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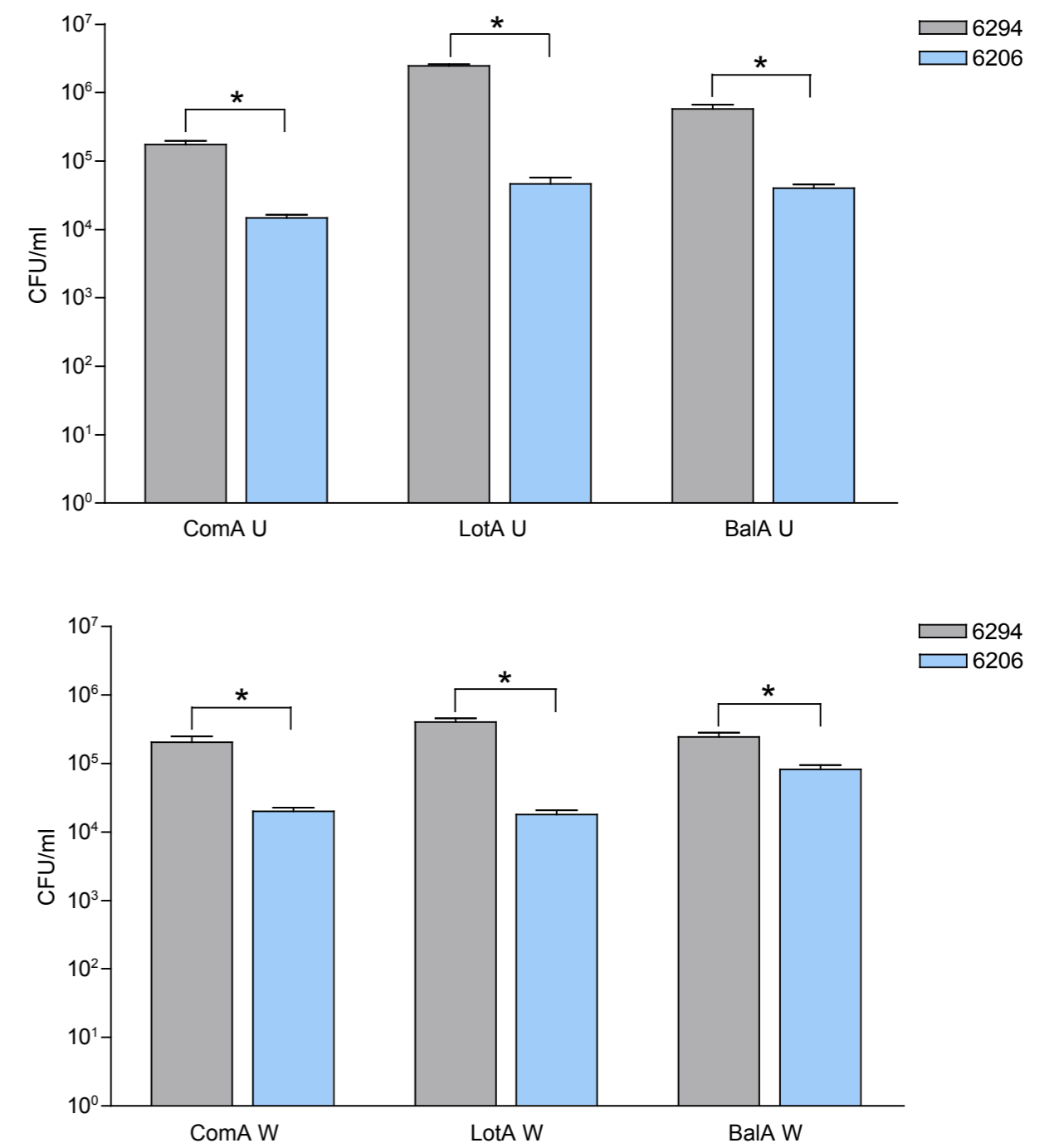


Figure 1: Adherence (mean CFU/ml \pm SD) of invasive (6294) & cytotoxic (6206) *P. aeruginosa* strains to ComA, LotA & BalA unworn (U) & worn (W) SiH CLs. The invasive strain (6294) showed significantly greater adherence to all W & U CL types compared to the cytotoxic strain ($*p < 0.05$).

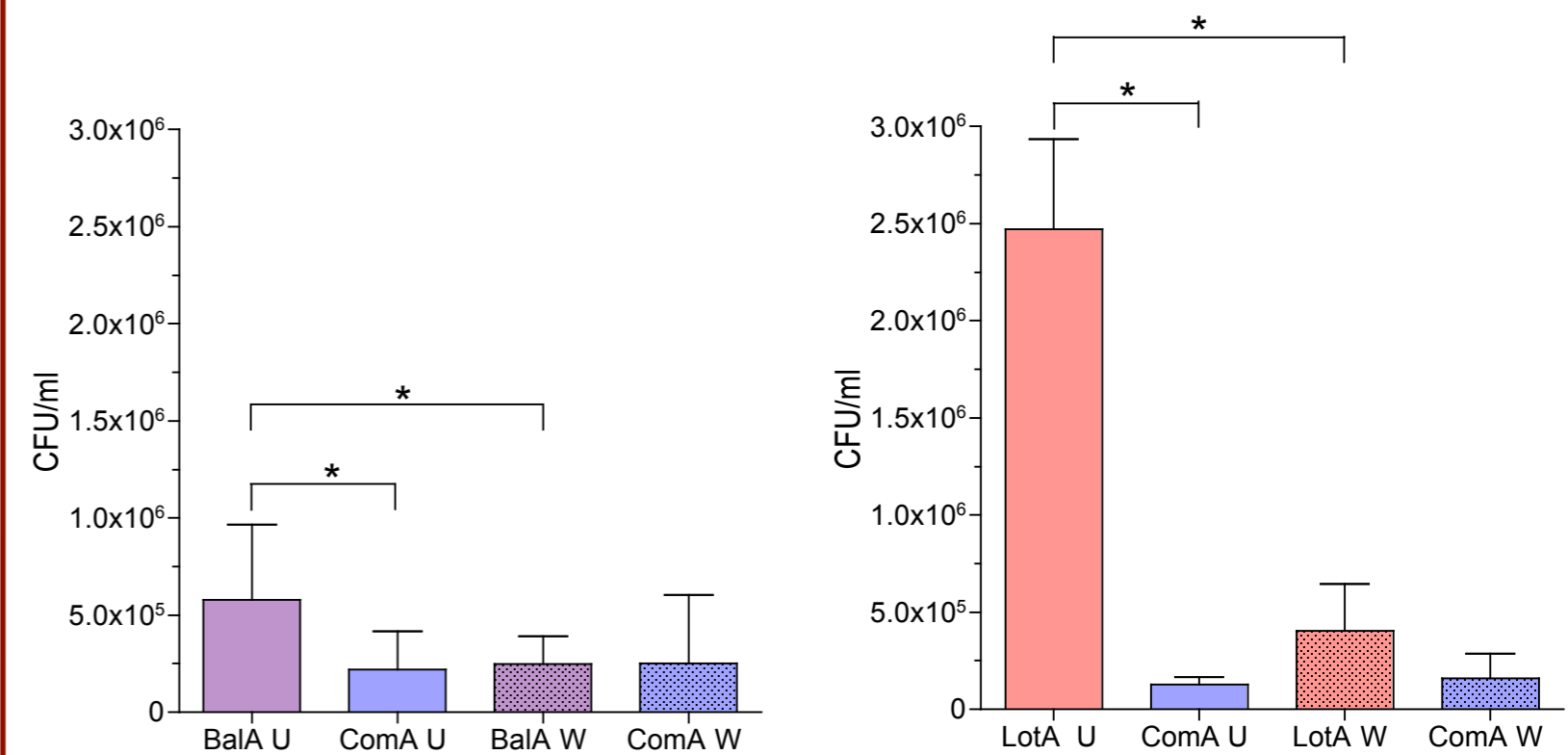


Figure 2: Adherence (mean CFU/ml \pm SD) of the invasive (6294) *P. aeruginosa* strain to the various unworn (U) & worn (W) SiH CLs. There was significantly greater adherence to BalA U compared to ComA U & BalA W ($*p < 0.05$). There was also significantly greater adherence to LotA U compared to LotA W ($*p < 0.05$). Adherence to ComA showed no significant changes after wear ($p > 0.05$).

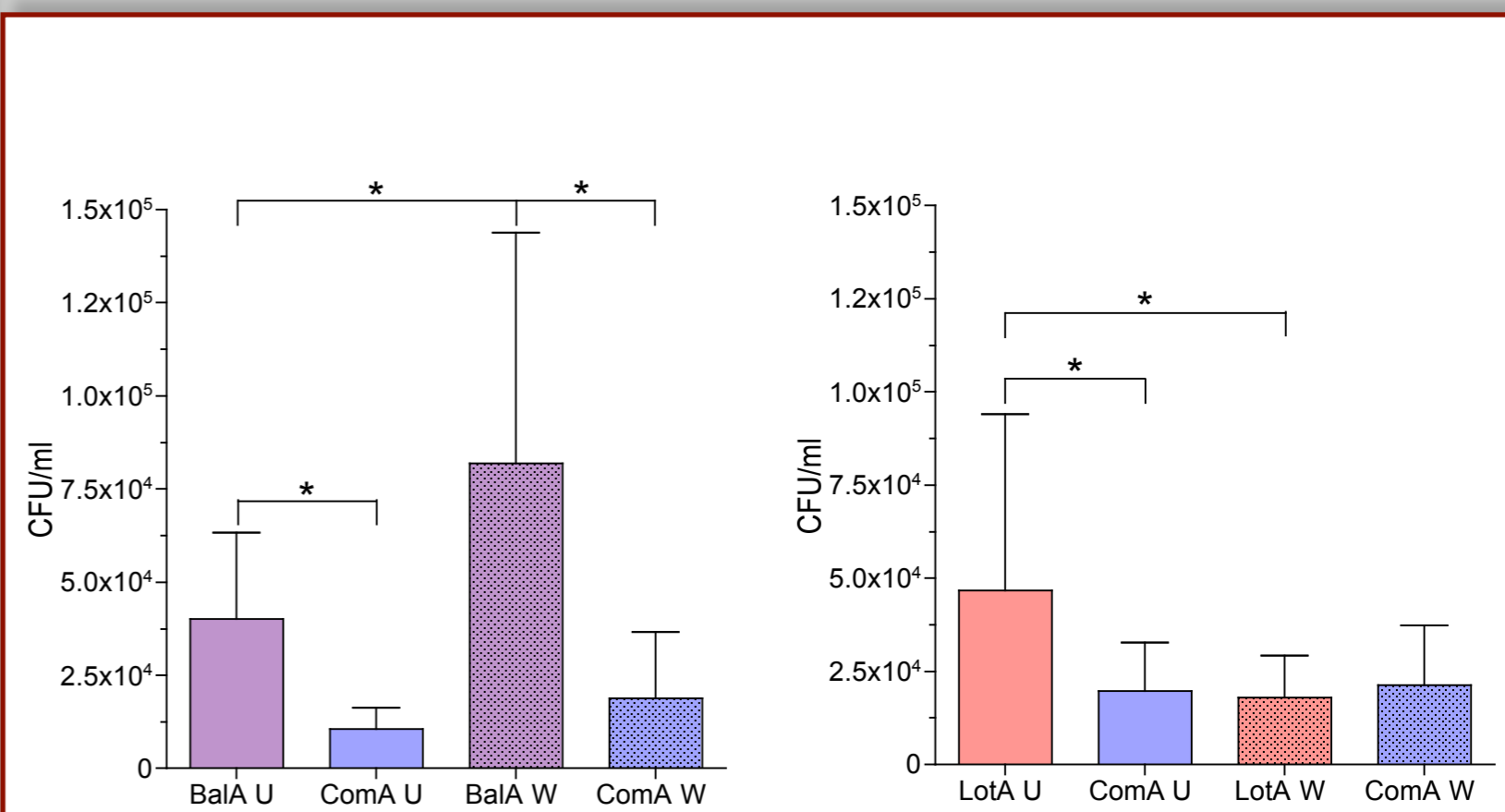


Figure 3: Adherence (mean CFU/ml \pm SD) of the cytotoxic (6206) *P. aeruginosa* strain to the various unworn (U) & worn (W) SiH CLs. There was significantly greater adherence to BalA W compared to BalA U and ComA W ($*p < 0.05$). Both BalA U & LotA U showed greater adherence than ComA U ($*p < 0.05$). After wear, adherence to LotA was significantly reduced ($*p < 0.05$) but remained unchanged with ComA ($p > 0.05$).

Acknowledgements & Address for Correspondence

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