

Cleaning efficacy and anti-bacterial properties of contact lens care solutions for orthokeratology lenses

○Yui Kahara, Rie Sasaki, Rie Tanaka, Sayaka Goto, Jacinto Santodomingo-Rubido and Taizo Sumide
(R&D center, Menicon Co. Ltd., Kasugai, Aichi, Japan)

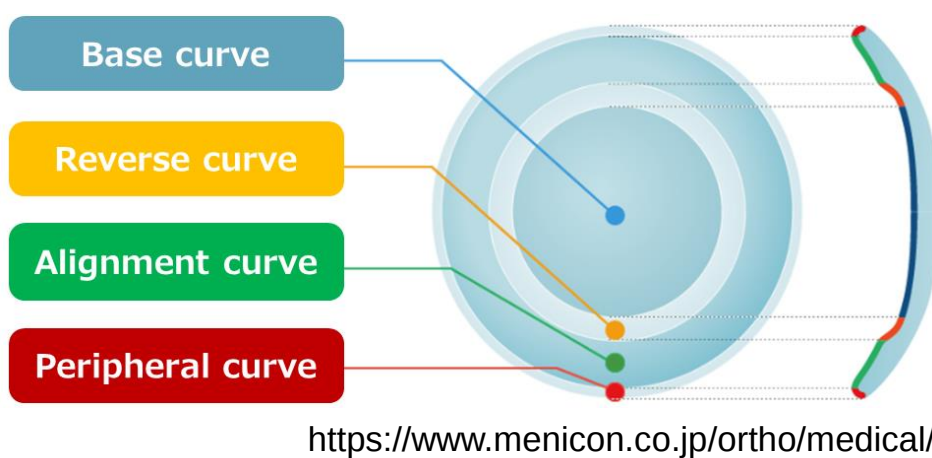
【 E-mail 】 y-kahara@menicon.co.jp
【 Financial disclosure 】
YK, RS, RT, SG, JS-R and TS are
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Introduction & Purpose

Deposits onto orthokeratology (OK) contact lenses can be difficult to remove, particularly along the reverse curve. Increased lens deposition at the reverse curve area may increase bacterial adhesion¹⁾, which could potentially lead to a greater risk of lens-related infection. The latter is supported by previous work conducted in our laboratory in which it was found that artificial deposits on OK lens increase the number of adhered *Pseudomonas aeruginosa* (PA) *in vitro*²⁾.

The purpose of this study is:

➔ To evaluate the cleaning efficacy and anti-adhesion properties PA of contact lens care solutions when used for OK lenses *in vitro*.



<https://www.menicon.co.jp/ortho/medical/>

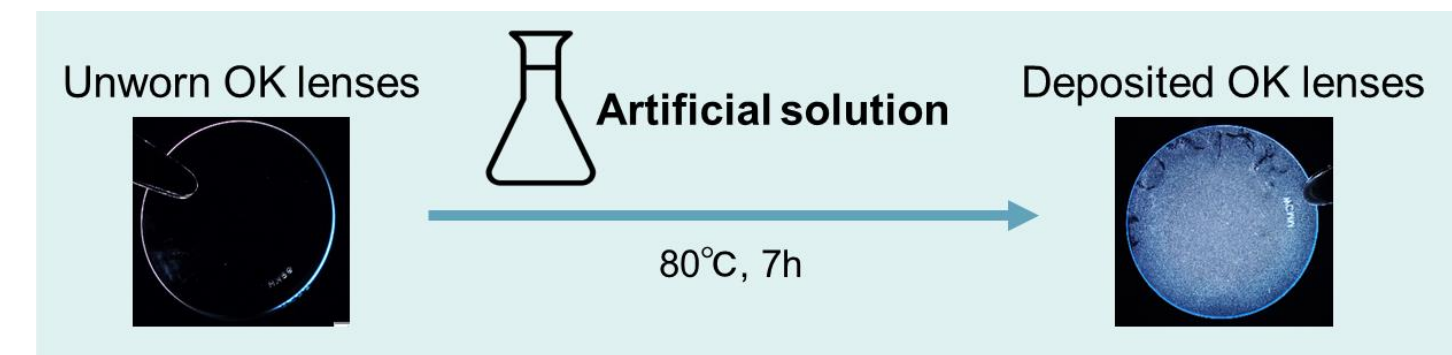
Experiment 1 The cleaning efficacy of three lens care solutions against artificial deposits on OK lenses

Experiment 2 The adhesiveness of PA onto OK lenses treated with three lens care solutions

Materials & Methods

Materials

- OK lenses were soaked in an artificial solution mimicking that of the tear film for 7hr at 80°C.
- Deposited OK lenses were randomly allocated to Group A and Group B.



Group A : Not cleaned (Control 1)

Group B*: Treated with contact lens cleaning/disinfecting solutions

Group C : Unworn OK lenses (Control 2)

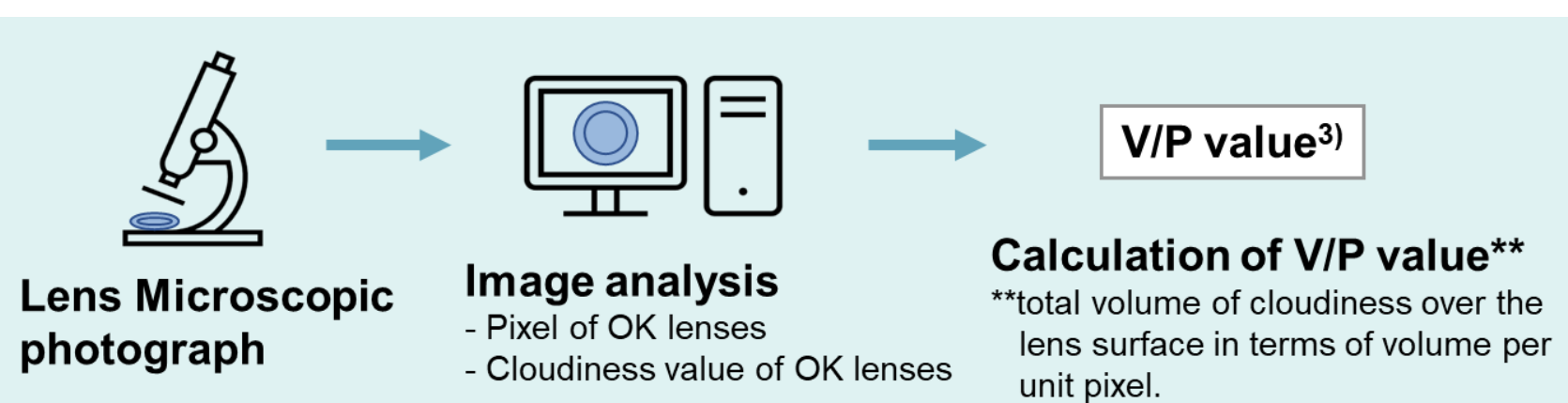
*Care solutions in groups B-1 and B-2 were assessed with and without rubbing

Table 1. Contact lens cleaning/disinfecting solutions. O, yes; -, no

Group B	Type of care solutions	Cleaning/Disinfecting agent	Soaking time*	Care regimens	Exp.1	Exp.2
B-1	Multi-purpose solution	Polidronium chloride	4h	Soaking	O	-
				Rubbing → Soaking	O	O
B-2	Hydrogen peroxide solution	Hydrogen peroxide	6h	Soaking	O	-
				Rubbing → Soaking	O	O
B-3	Chlorine-based solution	Sodium hypochlorite	30min	Soaking	O	O

Methods

Experiment 1



- Measurements were made in four lenses per group and a mean was obtained.
- The V/P values were compared between the seven groups using the Tukey-Kramer test using BellCurve for Excel (Social Survey Research Information Co., Ltd.).

Experiment 2



- Measurements were made in three lenses per group and a mean was obtained.
- Number of PA quantitative values were compared between the five groups using the Tukey-Kramer test using BellCurve for Excel (Social Survey Research Information Co., Ltd.).

Results & Discussion

Experiment 1 Total deposition on OK lenses

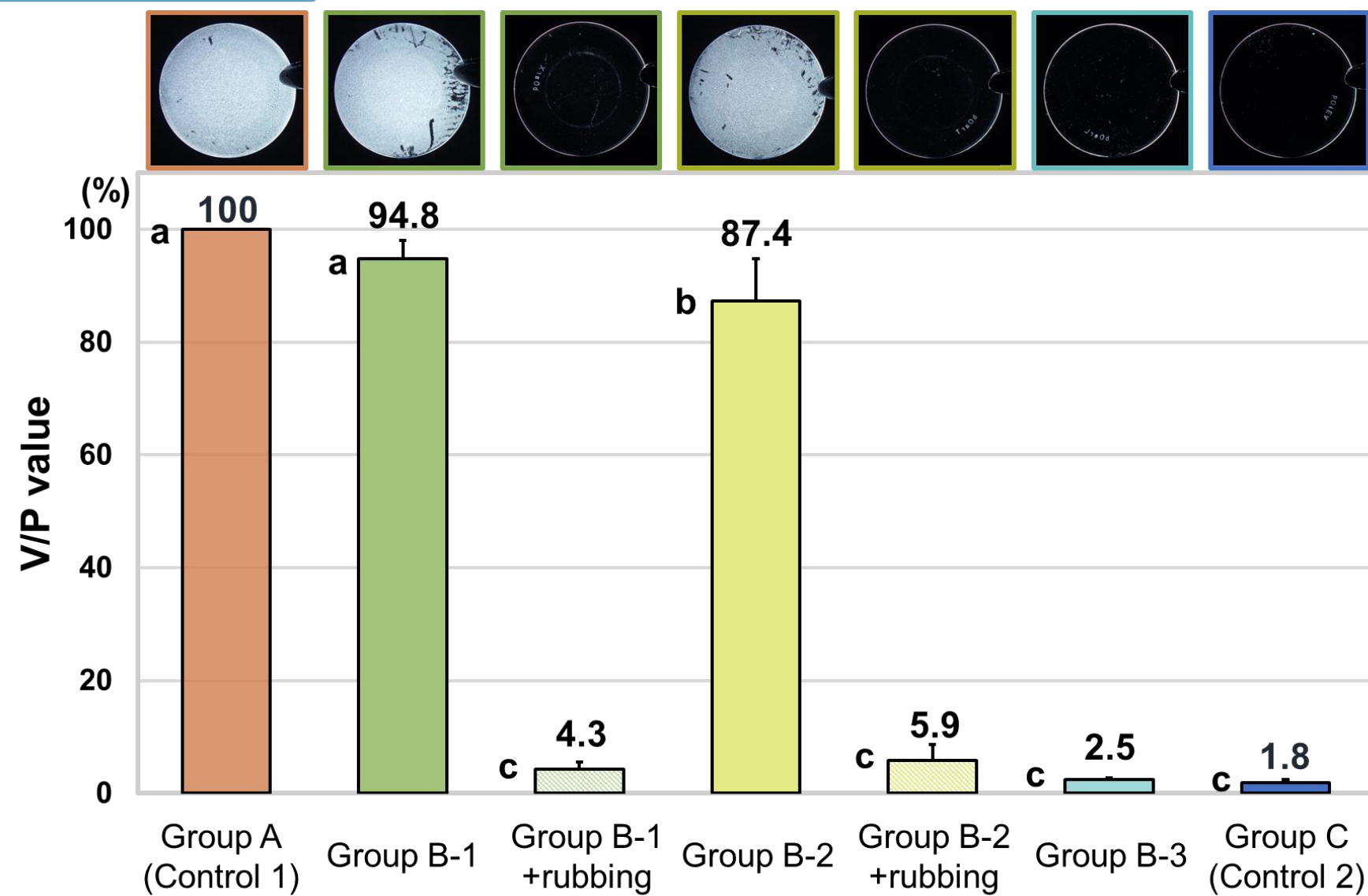


Figure 1. Mean V/P values ± SD for the different conditions ($p<0.01$).

Statistically significant differences were found between “a”, “b” and “c”. More specifically, V/P values in “a” were significantly higher than those found in “b” and “c” (all $p<0.01$); and V/P values in “b” were significantly higher than those found in “c” (all $p<0.01$).

Experiment 2 Adhesiveness of PA onto OK lenses

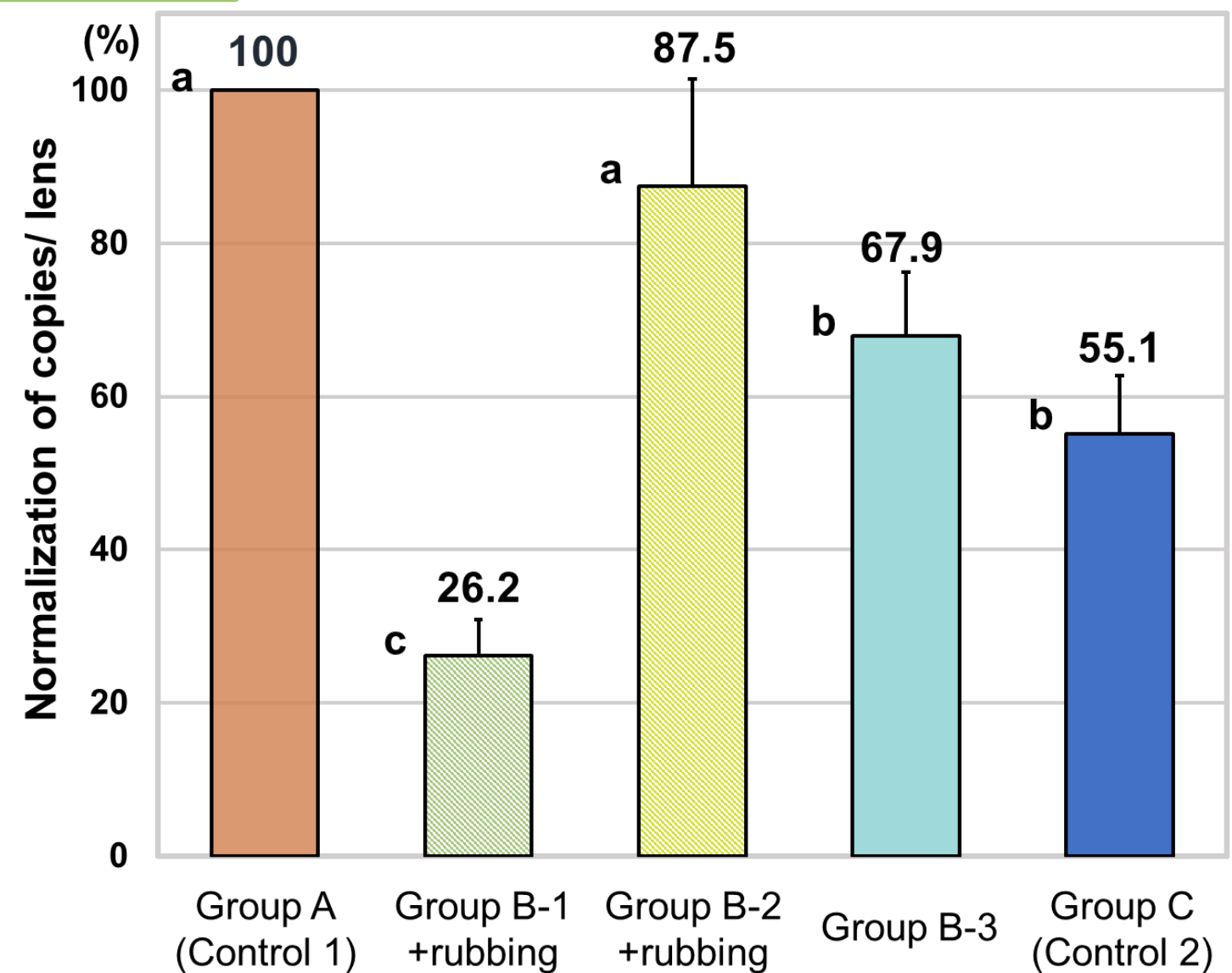


Figure 2. Mean number of PA ± SD for the different conditions ($p<0.01$).

Statistically significant differences were found between “a”, “b” and “c”. More specifically, the number of PA for Group B-2+rubbing was higher compared to Group C ($p<0.01$); the number of PA for Group B-3 was quantitatively equal to Group C ($p>0.05$); and the number of PA for B-1+rubbing was significantly lower compared to Group C ($p<0.01$).

- Compared with Group A, the V/P value for the different OK lens conditions reduced by 5.2% in Group-B-1; by 95.7% in Group-B-1+rubbing; by 12.6% in Group B-2; by 94.1% in Group-B-2+rubbing; and by 97.5% in Group B-3.
- Compared with Group A, the adhesiveness of PA for the different OK lens conditions reduced by 73.8% in Group B-1+rubbing; by 12.5% in Group B-2+rubbing; and by 32.1% in Group B-3.

The multi-purpose solution and hydrogen peroxide solution, when used including a rubbing step (Groups B-1 and B-2), and the chlorine-based solution (Group B-3) significantly removed deposits from the surface of OK lenses. Moreover, the chlorine-based solution (Group B-3) was able to remove deposits and reduce PA adhesion to a level like that found in unworn OK lenses (Group C). Furthermore, the multi-purpose solution, when used including a rubbing step (Group B-1) was also able to reduce PA adhesion to less than that found in unworn OK lenses (Group C).

Conclusions

These results indicate that daily rubbing of OK lenses prior to using a cleaning/disinfecting solution and the regular use of chlorine-based solution are effective in removing deposits and keeping lenses clean, thus minimizing the adhesion of PA onto the lens surface, ultimately contributing to a reduced risk of OK lens-related complications.

References

- Choo JD, et al., Adhesion of *Pseudomonas aeruginosa* to orthokeratology and alignment lenses. *Optom Vis Sci.* 2009;86:93-7.
- Sumide T, et al., Effects of artificial deposits on adhesiveness of *Pseudomonas aeruginosa* onto orthokeratology lens. *GSLs* 2020.
- Hiraoka T, et al., A novel quantitative evaluation of deposits adhered to worn orthokeratology contact lenses. *Japanese Journal of Ophthalmology* 2021;65:855-863.