

The effect of different types and concentrations of disinfectants on the decontamination of healing abutments

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Introduction

- Dental healing abutment are meant to be single-use objects.
- Dental practices often re-use healing abutments and they will be disinfected and sterilized based on universal guidelines for disinfection and sterilization of re-usable objects before re-using.
- Research has shown that 99 of 100 healing abutments were still contaminated after disinfection and sterilization and possibly with a high percentage of contamination (Wadhvani et al., 2016)
- Surface contamination occurs when a biofilm, mainly composed of gram-negative bacteria and anaerobic bacteria, covers the surface (Kubasiewicz-Ross et al., 2020).
- There is a chance that, when a healing abutment is re-used in a different patient, this can cause serious health risks due to cross-contamination. (Voet, 2017)

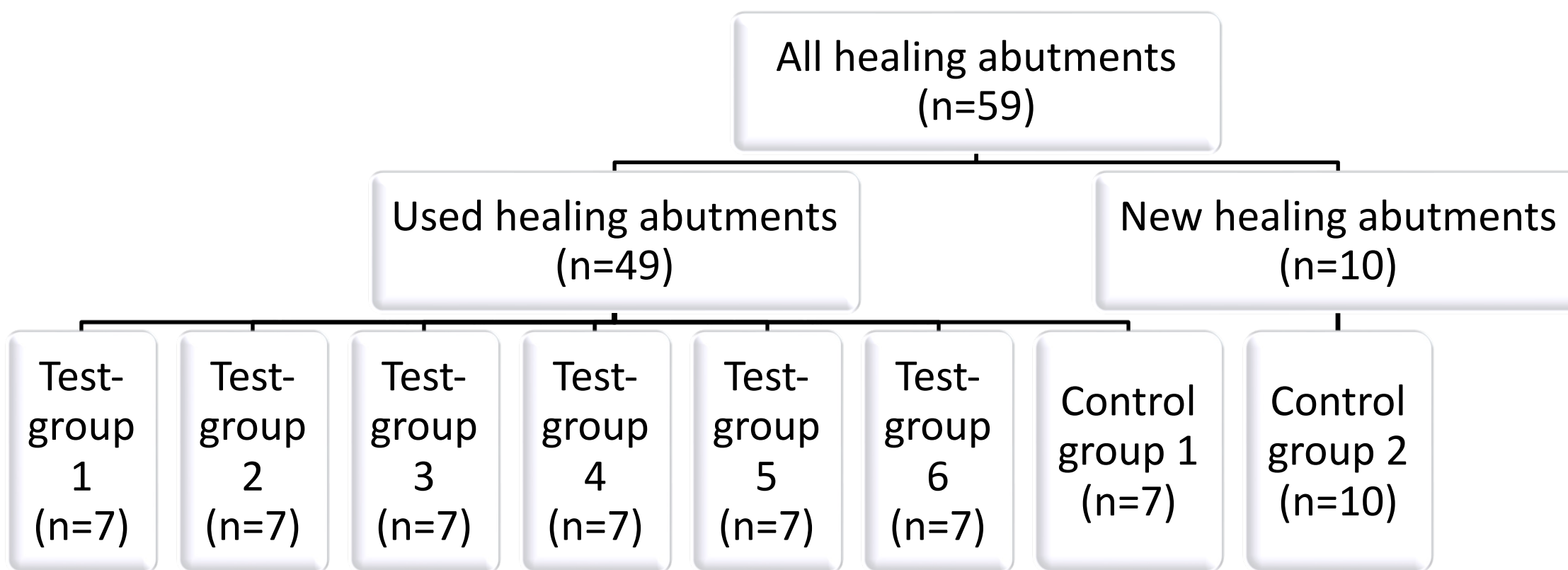
Objective: The aim of this study is to investigate the effect of different disinfectants on the degree of contamination in used healing abutments.

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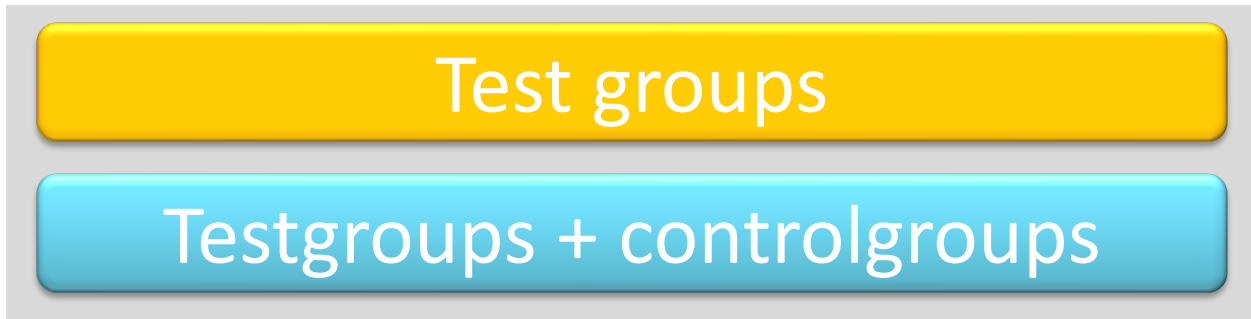
Material and Methods

Grouping healing abutments
For this study the total of 49 used healing abutments were divided into 6 testgroups and 1 controlgroup. The 10 new healing abutments make a seperate control group.



Group	Disinfectant
Testgroup 1	sodium hypochlorite (NaOCl) 5%
Testgroup 2	sodium hypochlorite (NaOCl) 1.0%
Testgroup 3	hydrogen peroxide (H2O2) 3.0%
Testgroup 4	hydrogen peroxide (H2O2) 1.0%
Testgroup 5	chlorhexidine (C22H30Cl2N10) 0.2%
Testgroup 6	chlorhexidine (C22H30Cl2N10) 0.12%
Control group 1	none
Control group 2	none

Procedure
The diagram on the right shows the procedure that has been used in this study. It is important to notice that the first step, immersion in disinfectant, only applies to the testgroups. The controlgroups have followed the procedure from step 3.



Statistic analysis
The metric variable that has been used in this study is the contamination-percentage. After collecting the data, the student t-test is performed to find any significant differences between two independant variables. The Levene test is used to verify that variances are equal across groups.

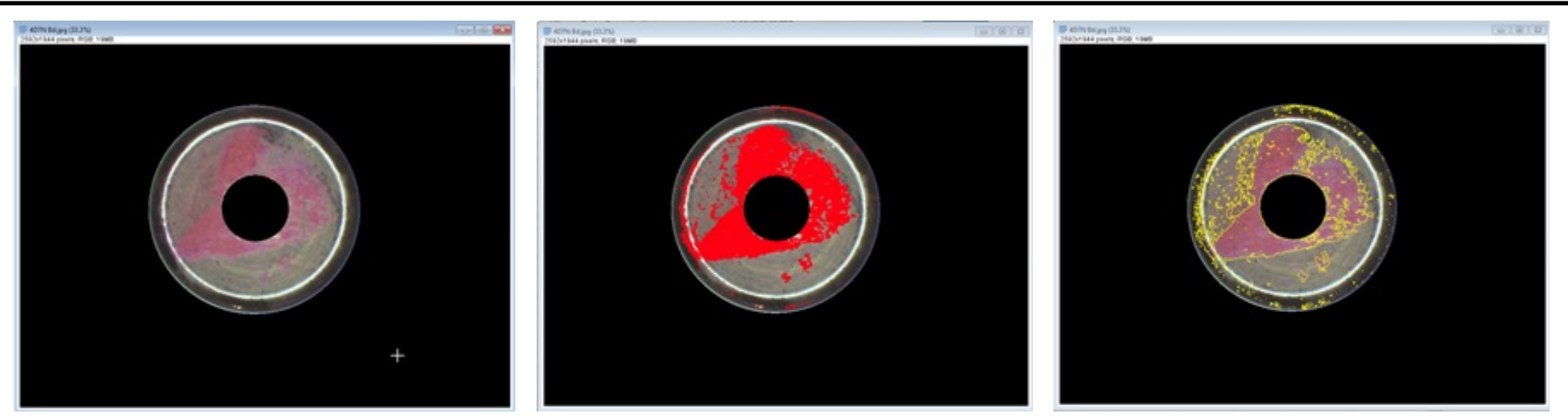


Photo-analysis with ImageJ software

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Results

Figure 1 shows the average reduction in contamination percentage per test- and controlgroup

- C1→ average contamination surface of 27.54% (sd = 20.59).
- C2→ a mean contamination percentage of 0.10% (sd = 0.06).

Comparing different testgroups with C1:

- T1→ average contamination surface of 1.53% (sd = 2.76), significantly lower than with C1 ($p = 0.0075$)
- T6→ average contamination surface of 13.36% (sd = 7.99). No significant difference compared to the mean of C1 ($p=0.058$).

Comparing the different test groups with C2:

- T1 versus C2 ($p=0.220$; 2-tailed) → significant
- T2 versus C2 ($p=0.068$; 2-tailed) → not significant

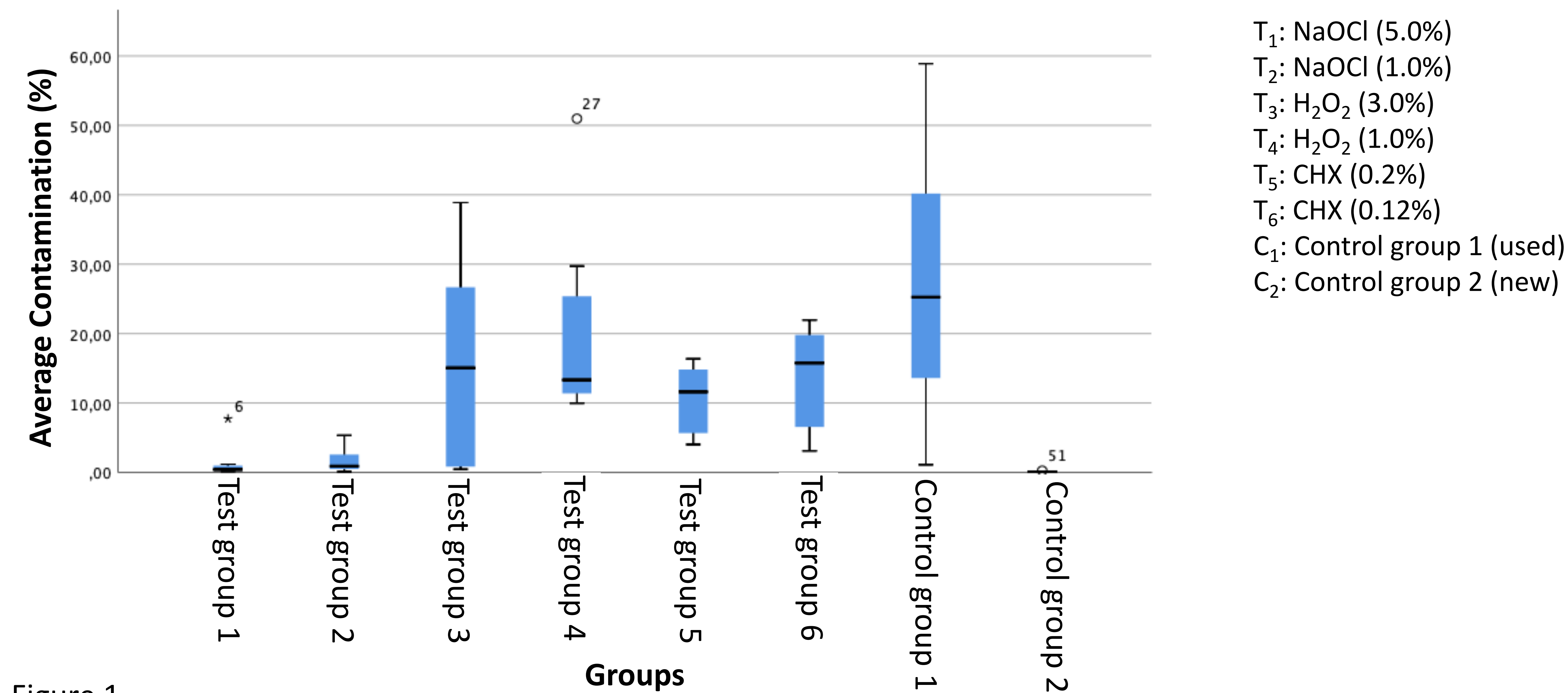


Figure 1

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Results

Figure 2 shows the average reduction in contamination percentage per test group compared to C1.

The mean contamination percentage of control group 1 was considered as reference:

T1 NaOCl (5.0%) reduces by 94.44%
T2 NaOCl (1.0%) reduces by 93.54%,
T3 H₂O₂ (3.0%) reduces by 43.25%,
T4 H₂O₂ (1.0%) reduces by 23.35%,
T5 CHX (0.2%) reduces by 62.16%
T6 CHX (0.12%) reduces by 51.49%

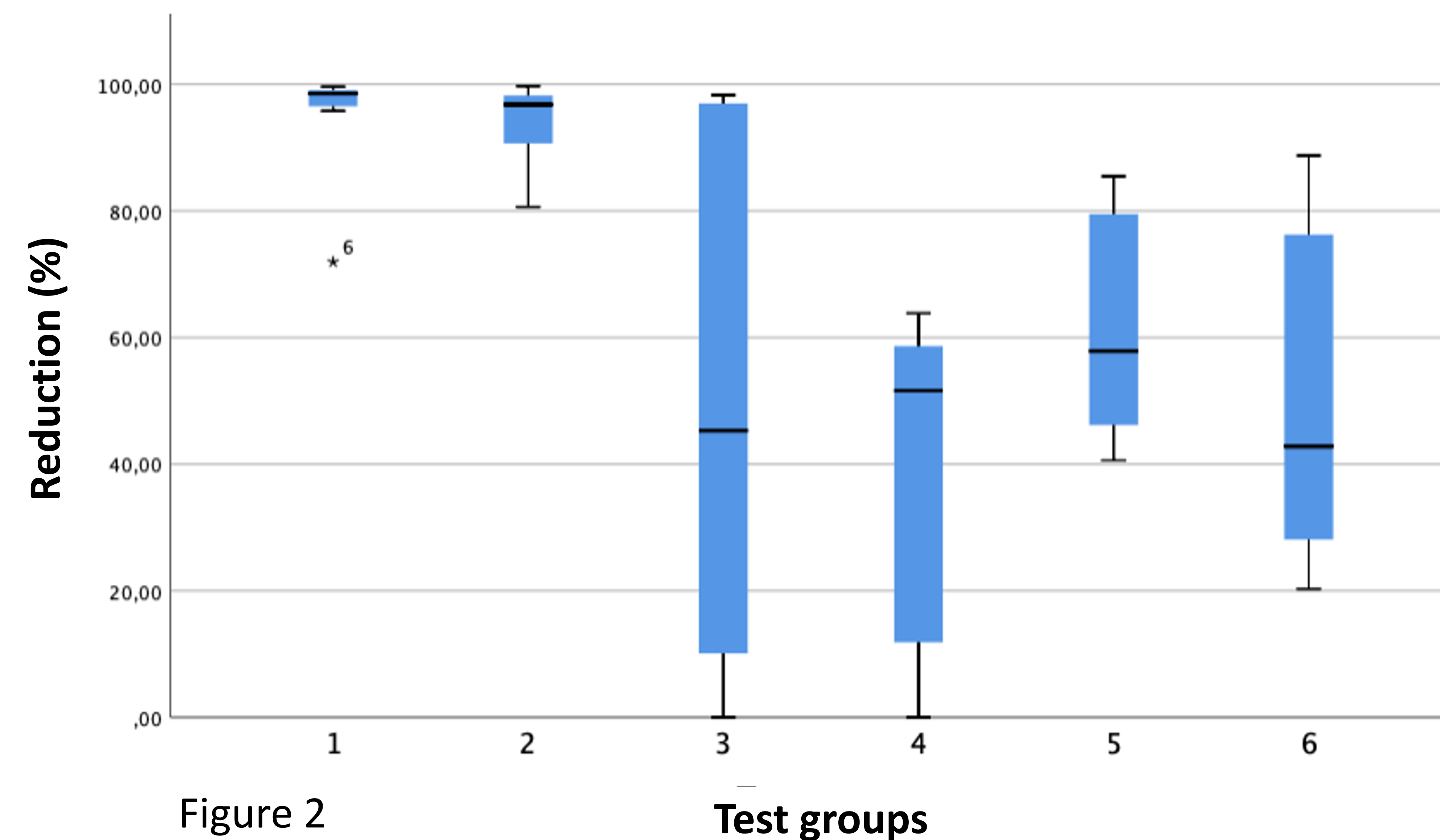
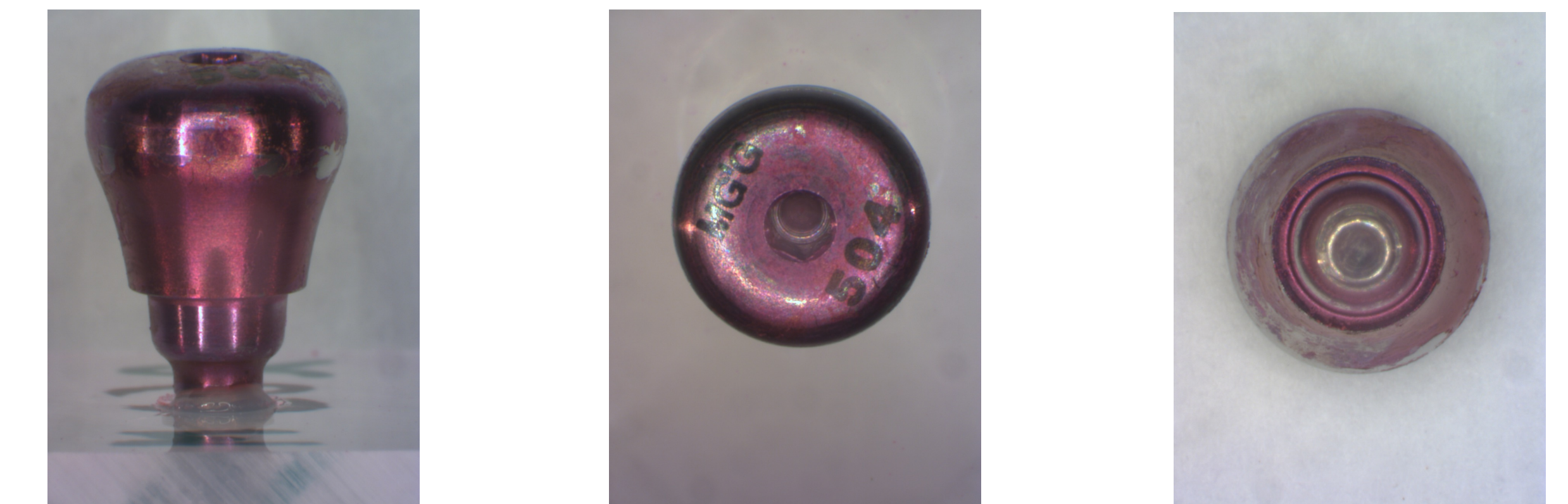
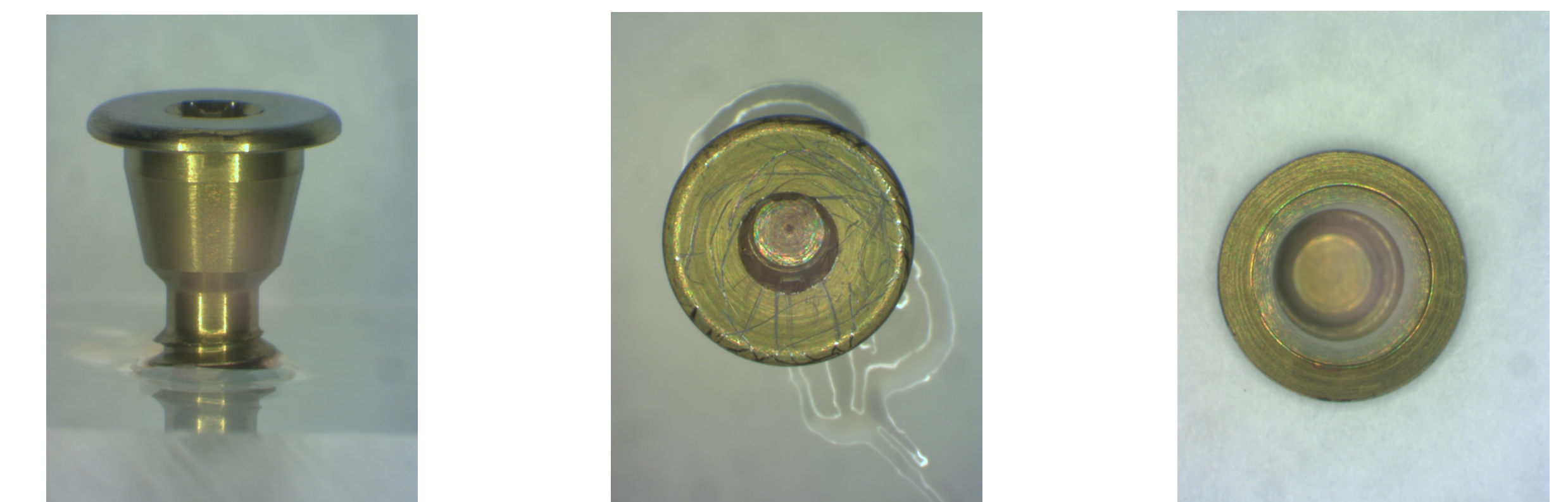


Figure 2



Illustrating the most contaminated healing abutment



Illustrating the least contaminated healing abutment

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Discussion

- It is clinically unacceptable that materials labeled as reusable after the regular disinfection and sterilization procedure are still contaminated
- Literature shows that other dental materials and instruments are also contaminated after the regular disinfection and sterilization procedure, as performed in practice
- New healing abutments, in contrast to used healing abutments, do not need to go through an additional disinfection procedure
- This study clearly show that there is a difference in contamination reduction between the different disinfectants studied

Conclusion

- This research shows that after a regular disinfection and sterilization procedure, healing abutments are still highly contaminated
- This contamination can be significantly reduced by immersion for 5 minutes in a 5.0% NaOCl solution
- This research provides a convincing reason to implement the additional disinfection using NaOCl in the regular disinfection and sterilization procedure, which are currently prescribed for dental practices