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Microbiological study using phase-contrast microscopy for the disinfection of complete dentures anchored to ball-attachment implants

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INTRODUCTION & AIM

The microbial environment surrounding implant-supported overdentures plays a crucial role in the long-term success of both the prosthesis and the supporting implants. The presence of biofilm on removable dentures has been widely associated with changes in the oral microbiota, increased accumulation of pathogenic species, and a higher risk of inflammatory complications affecting peri-implant tissues. Several studies have shown that prosthetic surfaces can harbor complex bacterial communities capable of maturing into biofilms that are difficult to remove with conventional hygiene practices. This biofilm acts as a reservoir for pathogens known to contribute to mucosal inflammation, peri-implant mucositis, and potentially peri-implantitis.
Evidence from microbiological investigations in other dental contexts demonstrates that inadequate hygiene and persistent biofilm accumulation can rapidly shift the microbial profile from a predominantly compatible, non-pathogenic flora to a pathogenic one characterized by spirochetes, motile bacteria, and anaerobic species. Such transitions have been observed even in otherwise stable oral environments when mechanical cleaning becomes insufficient or when oral hygiene devices are discontinued. Phase-contrast microscopy has emerged as a valuable tool for real-time assessment of oral microbiota, allowing clinicians to evaluate bacterial morphology and motility without the need for laboratory culturing. Given these considerations, regular disinfection of the prosthesis may contribute to preserving a compatible peri-implant flora and reducing the risk of pathogenic shifts.
The aim of this study is to analyze the effectiveness of a disinfection protocol for complete dentures anchored to ball attachments with respect to the peri-implant health of osseointegrated implants.

METHOD

Thirty patients were randomly divided into two groups. All thirty patients had compatible flora (absence of spirochetes/Treponema denticola) at phase-contrast microscopy sampling.

Fig. 1: Phase-contrast microscope in periodontal office.

This was due to the modified oral hygiene protocol (sonic toothbrush and oral irrigator twice daily). The use of the irrigator was discontinued for all thirty patients. Group A disinfected their dentures with EC Ster daily, while Group B did not use EC Ster.

Fig. 2: EC Ster.

Peri-implant flora was re-examined with phase-contrast microscopy every month for 6 months.

RESULTS & DISCUSSION

Peri-implant microbial evaluation was performed monthly for six months.
At baseline, all 30 patients showed compatible flora at phase-contrast microscopy.
Patients in Group A maintained compatible flora at all samplings, but patients in group B did not. After discontinuation of the irrigator, Group A (EC Ster users) maintained compatible flora at all follow-ups, whereas Group B (no disinfection) progressively developed pathogenic microbiota.

Table 1. Incidence of incompatible flora over time

Month	Group A (EC Ster)	Group B (No EC Ster)
1	0/15 (0%)	2/15 (13.3%)
2	0/15 (0%)	5/15 (33.3%)
3	0/15 (0%)	8/15 (53.3%)
4	0/15 (0%)	10/15 (66.7%)
5	0/15 (0%)	15/15 (100%)
6	0/15 (0%)	15/15 (100%)

At the six-month evaluation, incompatible flora was detected in 0% of patients in Group A compared with 100% in Group B, and Fisher's exact test confirmed this difference to be highly significant ($p < 0.0001$). Analysis of microbial progression across monthly follow-ups demonstrated a marked and statistically significant upward trend in the incidence of incompatible flora within Group B, as validated by a Cochran–Armitage trend test ($p < 0.0001$). No patient in Group A developed pathogenic flora at any time, indicating a strong protective effect of daily denture disinfection. These results collectively show that the absence of chemical disinfection leads to a rapid and progressive microbial deterioration, whereas consistent use of EC Ster effectively maintains a stable and compatible peri-implant microbiota over time. Peri-implant parameters were stable and constant in group A, but they slowly worsened in group B (plaque index, bleeding on probing, peri-implant probing).

Table 2: Clinical peri-implant parameters (mean ± SD)

Parameter	Group A (EC Ster)	Group B (No EC Ster)
Plaque Index (0–3)	M1: 0.6 ± 0.2	M1: 0.8 ± 0.2
	M3: 0.6 ± 0.3	M3: 1.2 ± 0.3
	M6: 0.7 ± 0.2	M6: 1.6 ± 0.4
Bleeding on Probing (%)	M1: 4 ± 2%	M1: 6 ± 3%
	M3: 5 ± 2%	M3: 12 ± 4%
	M6: 5 ± 3%	M6: 20 ± 5%
Peri-implant Probing Depth (mm)	M1: 2.1 ± 0.3	M1: 2.2 ± 0.3
	M3: 2.1 ± 0.2	M3: 2.6 ± 0.3
	M6: 2.2 ± 0.2	M6: 2.9 ± 0.4

CONCLUSION

The present study shows that daily disinfection of implant-retained complete dentures with EC Ster effectively preserves a compatible peri-implant microbiota over time. Patients who adhered to the disinfection protocol maintained stable microbial profiles and consistent peri-implant clinical parameters throughout the six-month follow-up. In contrast, the discontinuation of denture disinfection resulted in a progressive shift toward incompatible flora and a gradual worsening of peri-implant indices in the control group. These findings highlight the importance of incorporating a structured and regular denture-cleaning regimen to maintain a peri-implant environment that is unfavorable to the development of pathogenic microorganisms, ultimately supporting long-term implant and soft-tissue health.

FUTURE WORK / REFERENCES

Future studies with larger samples and longer follow-up periods are needed to confirm these findings and to evaluate additional disinfection protocols or alternative cleansing agents for implant-retained overdentures.

1 Caccianiga P, et Al (2022)
2 Marsh PD, et Al (2017)
3 Ramseier C.A. et Al (2024)