In vitro evaluation of daily vs weekly denture cleansing regimens

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Objectives

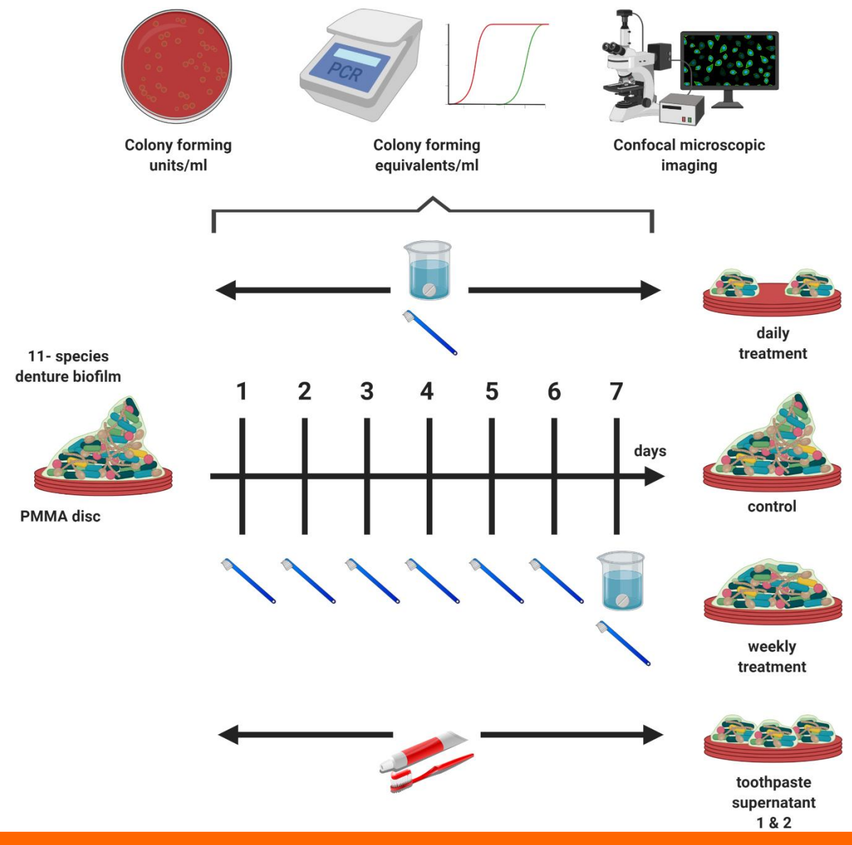
To compare the efficacy of daily denture cleanser (DDC) treatment with brushing using standard toothpastes or no treatment in removing and and killing *in vitro* denture biofilms.

Methods

- Biofilms were developed for 7 days on on PMMA discs(1)
- Comprised *S.mitis, S.intermedius, S.oralis, C.albicans, A.naeslundii, V.dispar, F.nucleatum and F.nucleatum ssp. vincentii, P.intermedia, P.gingivalis and A.actinomycetemcomitans*
- Biofilms were treated by
  - daily brushing and soaking with 3-minute exposure to denture cleanser (**DDC**)
  - brushing with wetted toothbrush, denture cleanser treatment on D7 only (**BR**);
  - daily brushing & soaking in toothpaste 1 slurry (25%w/w in hard water) – (**TP1**)
  - daily brushing and soaking in toothpaste 2 slurry (25%w/w in hard water) (**TP2**)
  - no treatment (**NT**) – negative control.

Biofilm viability was then measured by viable counting (VC, total aerobes, anaerobes and yeasts), qPCR (colony forming equivalents, CFE) and visualised using confocal laser scanning microscopy (CLSM).

Figure 1: Experimental Treatments – Daily, Weekly, Toothpaste 1, Toothpaste 2, Control



Results

Treatments were assessed by comparing the geometric means of VC or CFE.

- NT biofilms contained a geometric mean 1.99 x 10^9 CFU/ml.
- DDC treatment reduced this to 8.24x10^5 CFU/ml (2414-fold reduction).
- BR treatment reduced VC by 2.3-fold compared to NT.
- TP1 treatment reduced biofilm CFU by 10.1-fold vs NT, whereas TP2 reduced biofilms by 12.1-fold vs NT.
- Comparing DDC treatment to other treatments showed that this produced:
  - a 1034-fold reduction compared to BR
  - a 240-fold reduction compared to TP1
  - a 200-fold reduction vs TP2.
- Geometric means of total CFU of DDC treated biofilms were significantly better compared with all other treatments ($P<0.00041$ or less for each comparison, t-test).
- CFE analysis showed similar, significant benefits for DDC compared with other treatments.

Results

Figure 2: Daily Treatments CFU

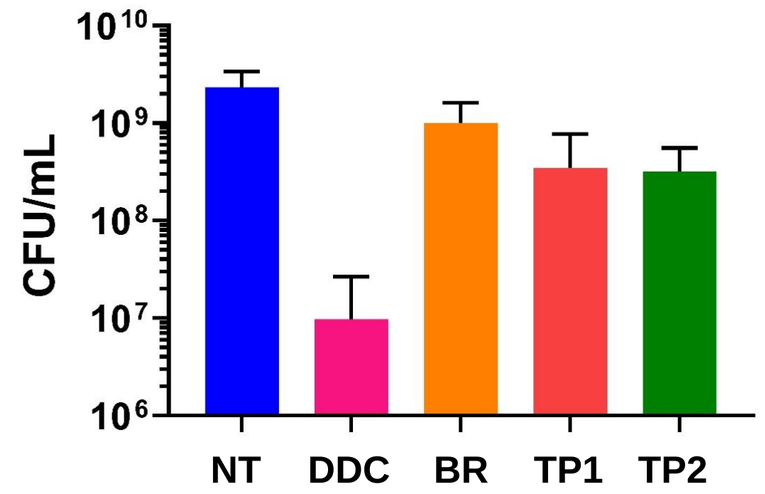


Figure 3: Fold Change in CFU vs Untreated Control

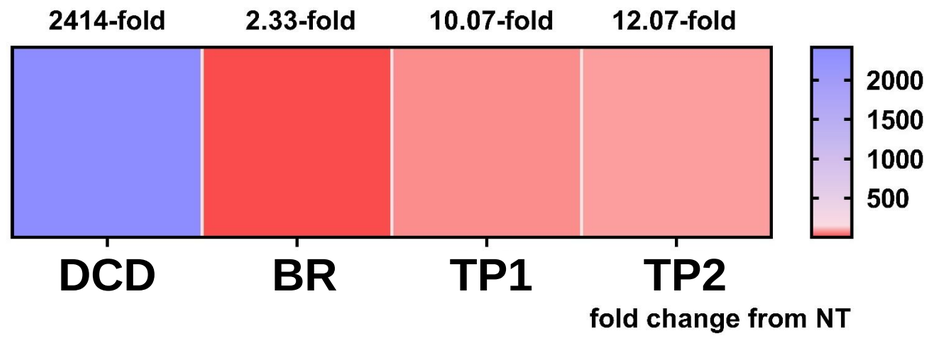
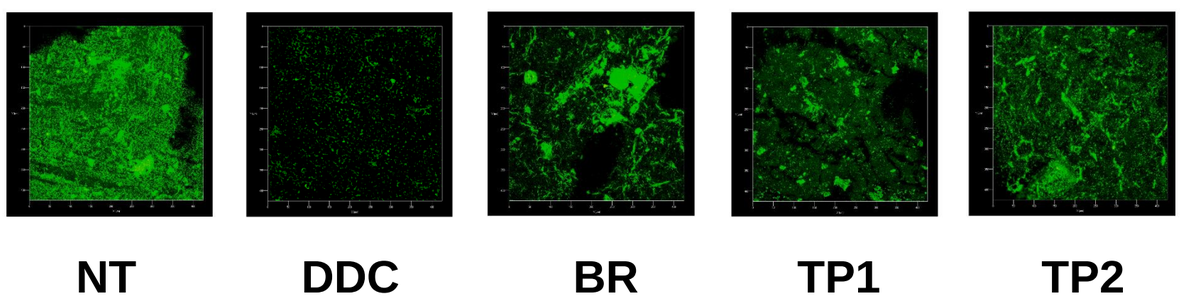


Figure 4: Representative CLSM Images of Treated Biofilms



Discussion

- Daily denture cleanser treatment gave a significantly greater reduction of biofilms than any other treatment or untreated control.
- Future studies could investigate the effects of toothpaste slurry effects on denture materials which although widely used by consumers can be potentially damaging for dentures(2).

Conclusions

- **Clear numerical differences (by CFU/CFE and visual differences (by CLSM) were observed between treated and untreated biofilms.**
- **Denture cleanser applied with brushing is a significantly more effective strategy for managing denture biofilms in comparison with no treatment or with intermittent treatment.**
- **Daily modality of treatment was more effective than weekly.**
- **Brushing with toothpaste was only moderately effective.**

References

1. O'Donnell LE, Robertson D, Nile CJ, Cross LJ, Riggio M, Sherriff A, Bradshaw D, Lambert M, Malcolm J, & MJ, Zaura E, Crielaard W, Brandt BW, Ramage G (2015). The Oral Microbiome of Denture Wearers Is Influenced by Levels of Natural Dentition. *PLoS One* **10**(9):e0137717.
2. Axe AS, Varghese R, Bosma M, Kitson N, Bradshaw DJ. (2016). Dental health professional recommendation and consumer habits in denture cleansing. *Journal of Prosthetic Dentistry* **115**:183-188.

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