Original Article

Bacterial cross-contamination between the dental clinic and laboratory during prosthetic treatment

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Abstract

Prosthetic treatment involves various stages in construction. This may result in cross-contamination between the dental clinic and laboratory. According to results obtained from the study, recommendations were made so as to reduce as much as possible cross-contamination, making a safer environment for the dental team and patient.

Introduction

Bacterial cross-contamination as a result of prosthetic treatment has been the subject of general comment but has received little specific attention.[1-6] Although a number of bacterial species have been isolated from impressions and dentures, few studies have attempted to isolate bacteria from intermediary appliances used in prosthetic treatment, such as occlusal rims and try-in dentures, which are returned to the laboratory and are a source of laboratory cross-contamination.[6] Most recent literature has focused on cross-contamination of prosthetic appliances in the dental laboratory.[7-8]

Keywords

Bacterial cross-contamination, prosthetic bacterial contamination, bacterial levels in pumice

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Khan *et al*, as far back as 1982, demonstrated conclusively that new dentures were contaminated during laboratory polishing and isolated not only commensal organisms but also pathogenic bacteria such as Group A and B streptococci, *Staphylococcus aureus, Escherichia coli* and *Candida albicans* from new finished dentures after polishing with pumice prior to being sent to the clinic.[8]

Verran *et al*, have shown that pumice can also be contaminated from sources other than patients' dentures and have isolated pseudomonads from water, staphylococci from skin contact and *Bacillus species* from the air. They were also able to demonstrate that mixing pumice with a disinfectant in a clinical laboratory reduces the microbial count. This reduction was reportedly short-lived.[2] Witt and Hart concluded that untreated pumice presents an unacceptable risk of cross-infection between patients, members of the dental team and ancillary personnel.[7]

The aims of the study was to quantify and type aerobic microorganisms transmitted from the Dental Clinic to the Dental Laboratory in a teaching hospital with a catchment area of 375,000 population.

Materials and methods

The items investigated were:

1. Centric jaw relation records – occlusal rims
2. Try-in full dentures
3. Dentures sent to the laboratory for repairs or additions
4. New full dentures

Twenty random samples from each item were taken over a period of five weeks. Samples were obtained by vigorously rubbing the items with sterile cotton swabs dipped in sterile physiological saline. The swabs were transported immediately to the Bacteriology Laboratory and were processed within one hour. Standard protocols for the culture and identification of bacteria in use at the Bacteriology Laboratory, St. Luke's Hospital were used.

The other aim of the study was to investigate the following laboratory items:

1. Pumice, and
2. The hydroflask

In this Dental Laboratory the pumice slurry is changed twice weekly. First the pumice is mixed with water to form a

Table 1: *Organisms isolated from the various specimens*

Organism	*Centric (%)*	*Try-In (%)*	*Add (%)*	*Repairs (%)*	*Pumice (%)*	*Hydroflask (%)*	*New F/ (%)*
Coagulase Negative Staphylococci	90	90	90	90	95	68	89
Staphylococcus aureus	0	0	12	0	60	42	0
Micrococcus species	95	85	80	87	0	12	88
Pseudomonas species	58	23	54	44	58	51	40
Bacillus species	95	76	89	80	90	89	85
Acinetobacter species	28	0	0	0	85	79	21
Streptococcus Group D	0	0	24	20	0	0	0
Klebsiella oxytoca	0	0	0	0	0	1	0

slurry, whilst on another day the slurry was formed by mixing with a 1% solution of sodium hypochlorite (acting as a control). Samples of 1ml pumice slurry were collected and diluted with 9mls Ringer's solution (Oxoid, Basingstoke, UK) on two working days after each change for 10 weeks. These were processed in the Bacteriology Laboratory, St. Luke's Hospital using the standard protocols for culture and identification of bacteria.

The hydroflask was identified as a source of cross-contamination in the dental laboratory however, after a thorough search, we were unable to find references investigating this source in the literature.

The hydroflask is used mainly for repairs and additions to prosthetic and orthodontic appliances. Immersion in water in the hydroflask at 40-50^{o}C at a pressure of 6 Bar allows curing of cold cure acrylic. Contamination of the hydroflask water therefore may provide a source of cross-contamination of appliances. In this dental laboratory the water in the hydroflask is changed once a week. A sample was obtained at the end of the working cycle for 19 continuous weeks.

Results and discussion

Table 1 shows the microorganisms isolated from the various items while table 2 shows the degree of contamination of the pumice slurry.

As would be expected the highest bacterial load was recorded in dentures sent to the laboratory for repairs and additions, while the lowest was recorded in new dentures after polishing with pumice. The low bacterial growth in centric jaw relations and try-in dentures can be accounted for by the short time these appliances are exposed to oral contamination.

Coagualse-negative staphylococci were isolated from all items; the highest at 95% in pumice samples and lowest 68% of samples taken from the hydroflask. *Staphylococcus aureus* was only isolated from 12% of dentures sent to the laboratory for additions, but was not isolated from either new dentures after polishing with pumice or any other clinical item despite being present in 60% of pumice samples and 42% of samples taken from the hydroflask, which might be due to the high temperature and pressure present inside.

There were two unexpected results with the isolation of *Micrococcus* species; although they were present in large numbers on all items exposed to oral contamination including repairs and additions, none were isolated from pumice samples however they still found their way on to 88% of new dentures. Furthermore, micrococci were isolated in only 12% of samples taken from the hydroflask.

Pseudomonas species and *Bacillus* species were present on all items averaging 47% and 86% respectively.

Acinetobacter species were isolated from only 285 occlusal rims and were not found in try-in dentures, repairs or additions. Despite this they were isolated in 85% of pumice samples and 79% of hydroflask samples and consequently isolated in 21% of new dentures.

Streptococcus Group D was isolated from 22% of additions and repairs and was not found in pumice or in the hydroflask. The solitary isolation of *Klebsiella oxytoca* from the hydroflask illustrates the point that any microorganism could contaminate the hydroflask.

This study confirms the findings of Verran *et al* that mixing pumice with a solution containing hypochlorite reduces contamination of oral microorganisms.[2] It is clearly shown in table 2 that the effectiveness of disinfected pumice is short lived. Whereas the difference between disinfected and non-disinfected pumice at 24 hours is significant at 2.6 x 10^6 Colony Forming Units (CFUs)/mL and 4.1 x 10^6 CFUs/mL respectively, at 48 hours the results show little difference, 4.2x10^7 CFU/ml and 3.9 x 10^7 CFUs/mL respectively.

Table 2: *Contamination of pumice slurry*

	Non-disinfected	*Disinfected*
24 Hours	4.1 x 10^6 CFU/ml	2.6 x 10^6 CFU/ml
48 Hours	4.2 x 10^7 CFU/ml	3.9 x 10^7 CFU/ml

Conclusion

The similarities, both in bacterial species and number, isolated from various stages in denture production in both the dental clinic and laboratory are a clear indication of the hazards of cross-contamination in prosthetic dentistry. Cross-contamination of non-sterilisable appliances in the dental clinic and laboratory pose a health hazard to members of the dental team and patients.

In accordance with international recommendations and in the light of our own study, all appliances including impressions should be thoroughly cleaned of blood, saliva and debris in 1% hypochlorite solution before delivery to and from the laboratory. The preparation of pumice slurry should be made up with sodium hypochlorite and changed daily. Brushes for denture polishing should also be treated with sodium hypochlorite. The hydroflask water should be changed and disinfected daily. Laboratories should change to using small size hydroflasks, and the water changed with each use.

These recommendations will not eliminate cross-contamination between the dental clinic and the dental laboratory or vice versa but will go some way to reducing it and making the environment for the dental team and patient a safer one.

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