Cross-Infection Potential of Impression Compound

By: Arpana Devi

Abstract

Purpose: To determine the cross-infection potential of impression compound as used clinically in certain developing country settings.

Materials and Methods: Microbiological tests were conducted on impression compound that are reused at the Colonial War Memorial Hospital, Fiji, to detect the presence of bacteria. Swabs of impression compounds were taken to identify the critical points at which bacteria may survive on the compound leading to the potential introduction of organisms into a patient's mouth. For plates showing growth, colonies were observed and identified using Gram staining, Microbact ™ identification kits and other biochemical tests.

Results: Transfer of viable organisms from patient's mouths was found on the compound at all stages of the impression process. Improper disinfection and storage of impression compound and trays allowed for the introduction of hospital pathogens on the compound that were not initially present from the patients.

Conclusion: Financial constraints may tempt the reuse of impression compound; they should however not be reused on different patients and appropriate universal precautions must be followed to decrease the likelihood of cross-contamination. PHD, 2009; (15) (2); pp. 33 - 37.

Keywords: Impression compound; cross-infection; nosocominal infections; Fiji.

Introduction

Dental professionals are potentially exposed to a wide variety of pathogenic microorganisms in the blood and saliva of patients. It has been shown that impression material can act as a vehicle for the transfer of both pathogenic bacteria and viruses which has an obvious implication for cross contamination in the clinic and from the clinic to the laboratory and patients[1].

Impression materials have been shown to absorb and retain viruses and viable organisms can still be present on impressions after five hours[9]. In one dental laboratory, an outbreak of Mycoplasma pneumonia infection was traced to a patient's denture and dental technicians have been deemed to be more at risk to hepatitis B than dentists and auxiliaries[2,3]. In developing countries where there are severe economic constrains, impression compound is the material of choice for taking impressions of edentulous ridges as it can be reused.

The literature indicates that there are no studies available to indicate the appropriateness or safety of simple disinfection of compound for reuse. As this material is used in the edentulous, who are often elderly and can be immuno-compromised, there is an increased potential health hazard risk when using contaminated dental materials. Studies have cautioned that the immuno-compromised patients may have an altered flora and be susceptible to infection with less than usual organisms that may result in septicemias that are potentially fatal[12].

With the steadily increasing frequency of diseases such as tuberculosis, hepatitis and AIDS, disinfection and sterilization procedures within dentistry have attracted the interest of many clinicians and researchers. The ethical and legal implications of infection control in the dental setting require that attention be paid to potential avenues of transmission that may have been ignored in the past[4].

The study aimed at determining if any viable organisms could be transferred from patients onto impression compound and if they are removed upon rinsing, and if impression compound acquires hospital pathogens following subsequent storage in an open environment before reuse.

Material and Methods

Ethical approval for the study was obtained. Written informed consent was obtained from ten edentulous participants at the Prosthetic Clinic seeking complete denture treatment.

Microbiological tests were conducted on impression compound to determine the presence of bacteria on it and their type. The samples, which were taken, all started as new, sealed and packed in their original boxes. The temperature of the water and the time in which the compound was immersed was also noted. The mean temp was 71.9°C and standard deviation of 9.90.

Swabs of the compound were taken at different points to establish at which stage dentists or technicians may be contaminating the compound with pathogenic bacteria that could be potentially introduced into patients' mouths.

The different swabs were taken as stated below:

1. Swabs of tray
2. After removal from original packaging.
3. After taking out of hot water (to see if the water had microorganisms).
4. After putting on to tray: before putting in patients' mouth
5. After rinsing with running tap water thoroughly so that no visible debris is seen on the compound.
6. Swab of cast after pouring.
7. Swab after storage of compound in the clinic for 1 week
8. Swab of water after reheating the compound.
9. Before reuse: before putting the compound into another patient's mouth

The swabs were taken, by slightly moistening in sterile saline and then randomly wiping across the entire surface of the compound. The swabs were placed into 1 ml of sterile saline and then vortexed for 1 min to separate out the organisms. Following this a 0.1ml of the liquid was used to inoculate the plates and broth.

Swabs of the compound were inoculated in chocolate agar for 48hrs and MacConkey agar for 24hrs while the inoculate from water baths were incubated in cooked meat medium for one week.

All media were incubated at 37°C. For plates showing growth, colonies were observed and identified using gram staining, Microbact™ 12A and 12B system to identify aerobic and faculatively anaerobic gram negative bacteria, coagulase, catalase and other tests. If growth was present in the cooked meat medium

it was subcultured into chocolate agar plates that were incubated aerobically and blood agar plates that were incubated anaerobically.

Each medium was challenged three times with a mixture of the following four isolates: *E. coli, S. aureus, P. aeruginosa* and *Streptococcus fecalis* to ensure that the media supported growth of common microorganisms.

Results

20 out of the total 90 sample plates (9 samples from each participant), which were inoculated did not show any growth. 60% of the unused compound from the manufacturers and its subsequent storage had bacteria (hospital pathogens) such as *Actinobaccillus species, Neiserria spp, Actinobacter baumanii, Capnocytophaga spp* and *Morgenella morganii.*

80% of disinfected trays also showed bacterial presence and these bacteria were also hospital pathogens. The mean temperature of the water in the baths was 72°C (Range= 55-91°C) and the impression compound was kept in the hot water for a mean time of 78 seconds (Range= 36-120 secs). 40% of the water, from the hot water baths in which the compound was immersed before being moulded also showed presence of bacteria. A total of 70% of the compounds displayed bacteria before being placed into the patient's mouth. 90% of compound samples displayed the presence of oral (eg: stomatoccoccus, S. aureus etc) and hospital bacterial following rinsing under tap water after impression taking. Following impression pouring, 80% of swabs from casts revealed bacterial transfer from impressions to the casts. Storage of the impression compound showed that keeping the compound in the hospital setting acts as a colonizing medium for hospital pathogens as all the samples (100%) showed presence of hospital pathogens.

Some species of hospital bacteria that appeared at all stages of this study, which could be pathogenic were; *Capnocytophaga species, Actinobacillus species, Actinobacter baumanii, M. morganii, Hemophillus species, Staphylococcus aureus* and *Viridans Streptococci.*

Discussion

Our study revealed that over half (60%) of our new impression compound possessed hospital pathogens. It is suspected that the compound became contaminated during storage in the clinical environment; hence it would seem prudent to isolate the impression compound.

In addition to the unused compound, the improperly sterilized trays (80%) can also be another source of cross-infection. Good practice recommends that impression trays are properly packaged, autoclaved and stored. The water used in the hot baths was not sufficiently effective in killing bacteria as, 40% of the sampled water was contaminated, even though the mean temperature of the water used was 11°C greater than that recommended by the manufacturers (61°C) to make the compound moldable.

As shown by our study, greater than two-thirds (70%) of impressions about to be inserted into the patients' mouths were contaminated, this is the first crucial stage where cross-infection can occur.

Merely rinsing impressions under tap water until all visible debris is removed does not disinfect the impressions. Furthermore, improper disinfection of impressions and impression pouring procedures produced contaminated casts, which can be a source of infection to laboratory and clinical staff[13]. Casts improperly disinfected can be an occupational hazard for technicians and dentists. Viable microorganisms can be recovered even from within casts from impressions experimentally inoculated with bacteria[5].

After one week's (inappropriate) storage in a clinical environment of the compound and subsequent remolding for reuse by placement in hot water baths, the hot water was as previously mentioned, ineffective in killing bacteria at this crucial stage, leaving all (100%) impression material contaminated solely with hospital pathogens. This study revealed that most of the bacteria identified throughout the various stages were hospital pathogens, and may be a source of nosocomial infections. Usually the virulence of a microorganism is the major factor in determining whether infection occurs however, when considering nosocomial infections, an equally important factor is the patients overall health status, and their general resistance to infection[6]. While in the past (eg in the early 1950's) some highly virulent pathogens for example *Staphylococcus aureus*, were considered to be an essential prerequisite for infection, it is now recognized that host factors play an essential role in infections[7].

In fact, many hospital infections are caused by organisms of low virulence (eg *Staphylococcus epidermis*) in patients with a compromised host response. Recently *Staphylococcus epidermis* and other coagulase negative staphylococci, which are found on skin as normal flora, and were considered non-pathogenic, are now recognized as being responsible for many cases of infection[7].

Currently there are many immuno-compromised patients who are seen by dentists all over the world for prosthodontic therapy. For these patients cross-infection by iatrogenic exposure could be potentially fatal and if these patients are infected they can serve as important reservoir carriers of pathogens[7].

This study identified bacterial types but did not quantify the bacteria, which could have provided useful information about whether bacterial counts had changed over the different stages and if the bacteria present were sufficient in quantity to be of pathogenic risk.

Other studies examining different impression materials come to comparable conclusions that if proper disinfection procedures are not undertaken the impressions can act as reservoirs for infection[1,2]. A method of disinfecting impression compound recommended by some is to wash the compound thoroughly under running water as soon as it comes out of the patient's mouth and then immerse it in a 1:10 dilution of sodium hypochlorite solution for 15 minutes[3,8,9,10]. These recommendations could be further investigated and utilized if practical. Because of the steadily increasing frequency of infectious conditions such as AIDS, disinfection and sterilization procedures within dentistry have attracted the interest of many clinicians and researchers. Moreover, the ethical and legal implications of infection control in the dental setting require that attention be paid to potential avenues of transmission that may have been ignored in the past. Therefore the knowledge and understanding of microorganisms, and the nature of microbial infections, should be appreciated by all oral health professionals. Our microbial evidence illustrates that impression compounds should not be reused after simple rinsing with running tap water as practiced in some locations, on different patients as they can be a source of cross-infection particularly in immuno-compromised patients and dental staff.

Impression trays and poured casts can also be sources of cross-infection if not properly sterilized before utilization in the construction of dentures. Appropriate disinfection and sterilization procedures should be followed to decrease the potential of cross-contamination.

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"You can't do anything about the length of your life, but you can do something about its width and depth."

Evan Esar

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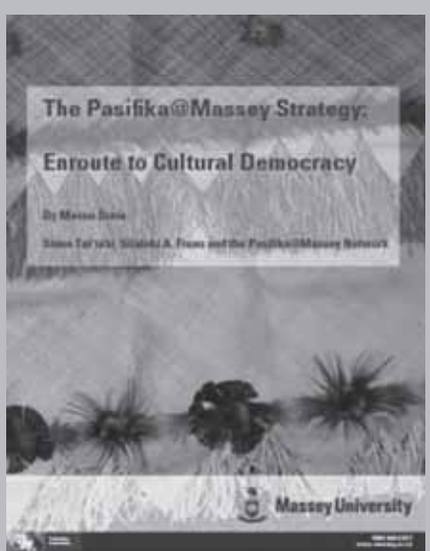

Pasifika@Massey Strategy:
Publisher House: Massey University, Directorate Pasifika@Massey
Authors: Mason Durie, Sione Tu'itahi, Sitaleki A. Finau and the Pasifika@Massey network
Publish Date: July 2007
Executive Summary – Broad Aims and Strategic Goals
The primary aim of Pasifika@Massey is to increase gains for Pacific Peoples through teaching, research and consultancy services at Massey University. Secondary aims are to assist Massey University meet its Charter obligations for Pacific Peoples and to make a positive contribution to Pacific communities and Pacific nations. These aims recognize Massey University as a strategic University in the wider Pacific region, committed to the advancement of Pacific Peoples whether in New Zealand or in island states.

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Pasifika Leadership: An Issue of Quality and Relevance
Author: Dr S. Langi Kavaliku (Hu'a Kava-mei-Liku)
The Theme on which I was asked to talk to you about this evening is Personal Foundations of Pasifika Leadership: An issue of Quality and Relevance. Furthermore, amongst the objects of this particular Programme—as stated in the Briefing Notes[1] I was given—are three issues. Notes for a talk to Participants in the Pacific Health Leadership Development Programme 2006 on "Being a Pacific Leader" – Module Two: Individual Leadership at Hamilton, New Zealand; July 12, 2006.

- Understanding Pacific Cultural values and their influence
- One's perception and thinking; and
- Cultural values are integral to leadership and for this programme in particular, in the New Zealand setting.

I would like firstly, to comment on Personal Foundations of Leadership in relation to my own experience, then secondly how I think it may relate to leadership issues in general and your Leadership Development Programme in the New Zealand context in particular.

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