

The effect of immersion disinfectants on Dimensional stability and reproducibility of commonly used irreversible hydrocolloid: An in-vitro study

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Abstract

This study was conducted in D.A.V(C) Dental College Yamunanagar to find the most suitable immersion disinfectant which causes least dimensional changes and preserves the impressions property of reproducibility. Immersion of four randomly selected irreversible hydrocolloid was done for specified period of time in three disinfectants - Glutaraldehyde, Povidone-Iodine and Sodium hypochlorite. Reproducibility was evaluated by determining the extent of reproduction of 25, 50 & 75 micronmetre width lines as per A.D.A Specifications.

Key words: Irreversible Hydrocolloid impression, Disinfectant, Dimensional stability, Reproducibility.

Introduction

In ancient times around 3000 B.C , antiseptics such as pitch or tar, resins & aromatics were used by Egyptians. The fumes of burning chemicals were also used as disinfectants. In 1683 Antonj Van Leuwenhoek developed microscope and proved the existence of microorganisms. The research of Robert Koch in 1881 on disinfecting properties of steam and hot air mark the beginning of science of disinfection. Infection control is a cardinal issue in dental practice.¹⁰

As dental professional we are exposed to a wide spectrum of microorganisms in blood and saliva of patient. Dental treatment procedures starting with making of impression may be the first link in microbial contamination. American Dental Association (A.D.A) & Centre for Disease Control (C.D.C) recommend disinfection of impression materials before being transported to the laboratory,^{3,10} surface

disinfection destroys pathogenic microorganisms.

Materials & Method

The present in-vitro study was done by immersing different brands of irreversible hydrocolloid in disinfectants for different intervals .All samples were divided into four major groups . Each group was further subdivided into two subgroups A & B.

A-Represented samples for determining dimensional stability.

B-Represented samples for determining reproducibility.

Subgroups A & B were segregated into three minor subgroups according to disinfectants (a,b,c). Each having 15 samples .

a- Glutaraldehyde

b- Povidone Iodine

c- Sodium Hypochlorite

Each minor subgroup was further divided into three parts.

Part I-Immersion in disinfectant for 5 minutes.

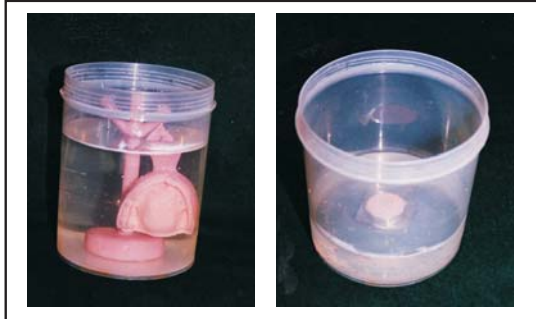
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Part II-Immersion in disinfectant for 10 minutes

Part III-Immersion in disinfectant for 15 minutes

Each part had 5 samples.

Figure 1



For subgroup A a custom tray was fabricated with acrylic resin. Acrylic tray hanger was fabricated. A metal Die with three cones (namely A,B,C) as shown in (Figure 2) was fabricated.

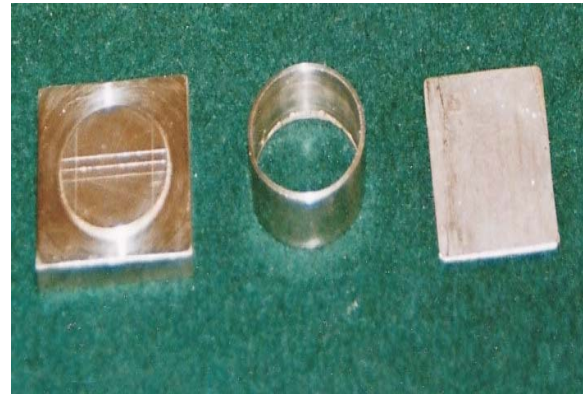
Figure 2



For subgroup B a steel Block containing engraved lines of 25.50,75 micronmetre width was fabricated (Figure 3). A metal ring was made to carry the impression material to the test block and a flat metal plate was used to press the impression material on the ring placed on block. A total of 180 samples were made for subgroup A & B each .

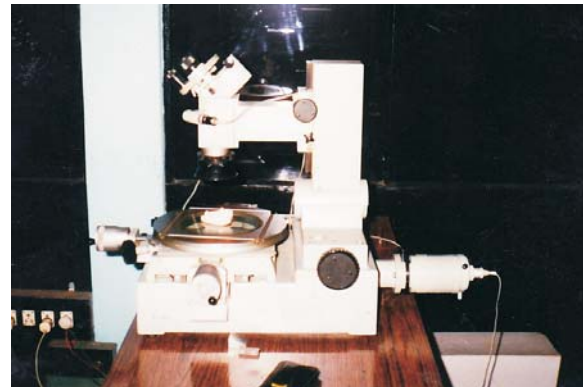
Travelling Microscope(Figure 4) with a least count of 0.01 mm was used for measuring dimensional stability in subgroup A. Distances between points A,B & C were measured.

Figure 3



For subgroup B a comparator mounted with a X10 magnification lens was specially designed. A low angle illumination with a light source attached

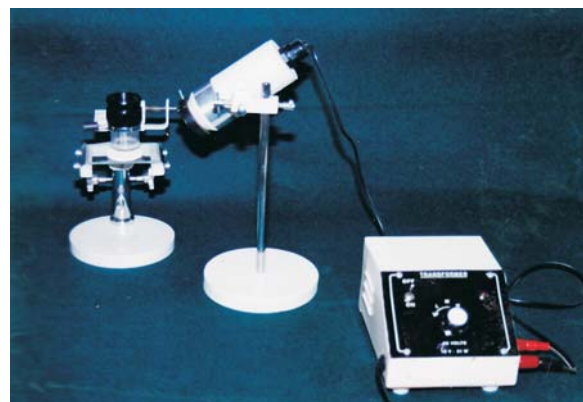
Figure 4



to a transformer was used for viewing lines of samples (Figure 5).

Samples in subgroup A,& B were made by making impression of respective dies, pouring impression with die stone (Figure

Figure 5



6). Control impressions were poured immediately.

Expression of results for Dimensional stability was done by determining change in percentage mean area.

Reproducibility was determined by evaluating lines by following criteria-

Score 1- Continuous well defined sharp line was reproduced.

Score 2- Continuous line with loss of sharpness.

Score 3- Break in continuity of line.

Score 4- No line reproduced.

Disinfectant showing maximum stability i.e minimal change in percentage area & also preserving the impression property of reproducibility was determined. Stastical Analysis used Mean, Three way analysis

Figure 6



of variance & Newman Keuls test for individual comparison of groups.

Results

Results showed that for 5 minutes immersion in disinfectant, 75% samples of irreversible hydrocolloid show least dimensional changes with Sodium Hypochlorite compared to other disinfectants. For 10 minute immersion 50% samples show least dimensional changes with sodium hypochlorite. For 15 minute immersion 50% samples of irreversible hydrocolloid show least dimensional changes with sodium hypochlorite.

* No particular disinfectant was found to favour all three dimensions.

* Long span dimension distorted more than short span dimensions.

* Reproducibility was comparatively not affected by time period selected for immersion.

Discussion

A number of microorganisms in the dental environment have been linked to debilitating & life threatening diseases. Every effort must be made to avoid cross contamination of these microorganisms & to prevent the potential transfer of disease in a dental setting. Accuracy & surface detail of impression should never be compromised. The use of A.D.A accepted disinfectants require 5 to 30 minutes of immersion disinfection. Immersion in Hypochlorite Iodophors or Glutaraldehyde is recommended by Council on dental materials, instruments & equipments.

"John A Molinari"¹⁰ stated that Centre for Disease Control has recommended use of 0.05% to 0.5% Sodium Hypochlorite as an effective agent in inactivating Hepatitis B Virus. Glutaraldehyde is A.D.A accepted has high Biocidal activity Iodophores have tuberculocidal activity within 5 to 10 minutes of exposure. "Xavier Lepe"⁹ stated that immersion & spray disinfection of the impression are more popular methods than cast disinfection. Immersion disinfection is more

reliable than spray disinfection because it guarantees that all surfaces of impression will come into contact with the disinfectant solution. "E.W Skinner" stated that if stone is poured to form cast within 12 minutes after the impression is obtained any change in dimension of impression is negligible. "John B Tullner"¹⁴ studied reproducibility for irreversible hydrocolloid impression material by immersion in disinfectant for 5,10 & 15 minutes by using test block engraved with 25,50 & 75 micronmeter width lines. Finest line of 25 micronmeter was used as criteria line.

Individually for each dimension disinfectants have a variable effect. No particular disinfectant was found to favour all three dimensions, indicating that there may be a cause in chemistry of alginate impression material that caused more leaching of ions from gel structure, disrupting the chemical bonds, thus leading to distortion of alginate this is in accordance with study of "Setsuo Saito"¹² who stated that disinfectant by changing osmotic pressure causes leaching of monovalent and divalent metallic ions from alginate impression material leading to distortion of impression.

It was observed that cross-arch dimension had a less significant effect than intra arch dimensions on mean percentage change in area i.e dimensional stability. This is in accordance with the study of "Herrera & Merchant"⁷ who found that maximum cross arch diameter and canine to canine dimension were not significantly affected by immersion disinfection. Long span dimension distorted more than short span dimension. This is in accordance with study of "J F Burton"² who stated that short span impressions appeared to be far less sensitive to distortion than long span impressions regardless of cause. In the present study, it was observed that comparatively time of immersion did not have a significant effect on reproducibility. This is in accordance with study of "Richard D Schnell" who concluded that reproducibility is not dependent on time

of immersion. Variations in results of reproducibility could be in accordance with study of "D.H Pratten"¹¹ who stated that disinfectant treatment alters the surface chemistry of impression material changing the hydrophilicity of impression material, thereby rendering impression more wettable or less wettable by a slurry of gypsum.

The models obtained after immersion disinfection of impression material were either larger or smaller than the control group models, this may effect the prosthesis fit. Large size models can be beneficial in providing space for luting cements in fixed prosthodontics and also for compensation of shrinkage of gypsum during setting. If this factor of model size could be controlled and utilized for counteracting the setting expansion of die stone & casting shrinkage of metals than the accuracy of prosthesis could be improved., thus disinfectant could be provided with beneficial effect of removing microorganisms & improving the fit of prosthesis.

Conclusion

Distortion of an impression is not caused by material alone. Dimensional stability and Reproducibility did not differ significantly for 5,10,15 minutes immersion. The decision in selecting type of impression material depends on individual preference, experience or needs of dentists. Factors such as handling, working characteristics, patients comfort or economics help to determine the choice of impression material.

Further studies may be done to determine potency of disinfectants and effect of many other factors, such as relaxation of stresses, excessive seating pressure, impression technique. Threat of cross infection is raising a challenge to profession- Research & Practice is one small step to meet the challenge.

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