Hemalatha.R et al /J. Pharm. Sci. & Res. Vol. 8(7), 2016, 661-664

ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

Disinfection of Dental Impression- A Current Overview

Dr.Hemalatha.R B.D.S
Post Graduate Trainee
Saveetha Dental College
Chennai-77

Dr.Dhanraj Ganapathy MDS
Professor and H.O.D
Department of Prosthodontics
Saveetha Dental College,Chennai-77

Abstract:
Dental impression can act as a means of transmission of infectious agents such as hepatitis viruses, herpes simplex viruses, Mycobacterium tuberculosis and other micro organisms from patients to dental personnel who handle the impression or the casts. It has been a customary to rinse impression under running tap water to remove blood and saliva, but no routine method of sterilization or disinfection of dental impression has been accepted by dental profession. Difficulties in sterilizing impressions by traditional methods have led to chemical disinfection as an alternative, and some studies have shown that disinfectants may adversely affect impressions. Hence this structured review was initiated and done.

Keywords: Dental impression, Sterilization, Disinfection, Dimensional accuracy

INTRODUCTION:

Dental impressions can give rise to the transmission of microorganisms and infections. Impression materials that have been exposed to infected saliva and blood provide a significant source of cross contamination[1]. Many contagious diseases such as AIDS, hepatitis, herpes I and II, tuberculosis, and many others can be prevented by practical control of infection in the dental office. The prevalence of the human immunodeficiency virus (HIV) and other infectious diseases in blood and other body fluids has influenced the necessity for personal protection and the prevention of disease transmission[2]All surfaces that have been splashed or touched by human body fluids must be disinfected with a hospital-grade disinfectant that has been registered with the Environmental Protection Agency (EPA).[3]

A working cast of dental stone used with cast dental restorations must provide dimensional accuracy, strength, and resistance to abrasion, and must reproduce surface detail. Because dimensional accuracy and reproduction of anatomic detail are important requisites for an impression used in the fabrication of dental castings, it is of interest to investigate the effect that disinfectants have on the accuracy and reproduction of fine detail of impressions.[4]Impression materials disinfected by immersion, however may be subjected to dimensional changes which may have a direct effect on the prosthetic results achieved in dental practices.[1]

TYPES OF IMPRESSION MATERIALS:

Major advances in impression materials and their application have occurred during the last decade, with greater emphasis being placed on rubber impression materials than on dental compound, zinc oxide-eugenol, and agar and alginate.[5]

There are various classifications of impression materials but the major types are:

Mode of setting	Rigid	Elastic
Set by Chemical reaction(irreversible)	Impression plaster, Zinc oxide eugenol	Alginate, Polysulfide, Polyether, Silicone
Set by temperature change(Reversible)	Compound, Waxes	Agar hydrocolloid

RIGID IMPRESSION MATERIALS:

Impression compound:

The application of dental impression compound has also decreased with the increased use of rubber impression materials, however, impression compound is useful for checking cavity preparations for undercuts and for making impressions of full crown preparations where gingival tissues must be displaced. It softens on heating and hardens on cooling. Majorly used for making preliminary impression for completely edentulous mouth.[6]

Zinc oxide-eugenol

It is a mucostatic, inelastic, chemically setting impression material, used for recording secondary or wash impressions of edentulous arches. Although zinc oxide-eugenols are excellent materials for wash impressions of edentulous areas, they have been replaced to a large extent by light-bodied rubber impression materials.[7]

ELASTIC IMPRESSION MATERIALS:

Agar: Agar is chemically an organic, hydrophilic hydrocolloid extracted from certain seaweeds and is sulfuric ester of a linear polymer of galactose. In its natural state it a gel, but on heating becomes a sol. Majorly was used as tissue conditioner, for full mouth impression without deep undercuts, used extensively for crown and bridge impression before elastomers came to the market. Widely used at present for cast duplication. It is supplied as: Gel in collapsible tube for impression.[8]

Alginate: Its an irreversible elastic hydrocolloid. It is a mucous extract yielded from certain brown sea **weeds**. Its types are, Type 1 – Fast setting and Type 2- Normal setting. Applications are mainly used for impression making, when there are undercuts, in mouth with excessive flow of saliva, for impression to make study models and working casts, for making preliminary impression.[9]

ELASTOMERIC IMPRESSION MATERIALS:

Polysulfide Rubber Impression Material:

Polysulfide rubber impression material consists of **Base paste-**Low Molecular Weight Polysulfide with two terminal and one pendant SH groups, Fillers (Titanium dioxide) ,Plasticizer (Dibutyl phthalate) and **Catalyst paste**-Lead dioxide (Brown) or organic peroxides (Gray) reactor, Fillers (Titanium dioxide), Plasticizer (Dibutyl phthalate).Its Setting Reaction is by condensation polymerization (exothermic + shrinkage) with releasing of H2O as reaction by-product. It occurs as a series of simple oxidation reactions.[10]

Condensation Silicone Impression Material:

Condensation silicone impression material consist of **Base paste**-LMW silicone polymer with terminal OH groups, Fillers (Colloidal silica or titanium dioxide) (white) and **Catalyst paste**- Alkyl silicate (Cross linking),Tin dilaurate or Stannous octoate (Activator).Material sets via condensation polymerization reaction. Ethyl alcohol is the reaction by-product.

Addition Silicones Impression Materials:

Addition silicones impression materials consist of **Base paste-**Poly methyl hydrogen siloxane (Hydried or silane terminated silicone),Other Siloxane pre-polymers, Fillers and **Catalyst paste**-Divinyl poly(dimethyl siloxane),Platinum salt activator (Chloroplatinic acid) ,Siloxane pre-polymers,Fillers. Its setting reaction is addition polymerization (exothermic + shrinkage) with no release of by-product.It occurs as a series of cross-linkage between vinyl-terminated silicon and silane-terminated (hydried) silicon molecules, in presence of the catalyst (platinum salt) to form a 3D polymer network. More dimensionally stable than condensation-polymerized materials

POLYETHER RUBBER IMPRESSION MATERIAL

Polyether rubber impression material consist of **Base paste-**LMW polyether with terminal imine groups ,Filler (colloidal silica),Plasticizer (dibutyl phethalate or glycoether) and **Catalyst paste**- Aromatic sulfonate reactor (Sulfonic acid ester), Fillers ,Plasticizer. Material sets via Addition polymerization reaction (No by-product).More dimensionally stable than condensation polymerized materials. Set material is so stiff (as a result of high rate of crosslinking), so tray adhesive must be used to retain the material within the tray at the time of removing an impression.[11]

MODE OF ACTION OF CHEMICAL AGENTS:

There are various methods of action of the chemical agents. The most common modes are Protein coagulation, Disruption of the cell membrane**,** Removal of the free sulphydryl groups and Substrate competition.

Disinfecting Agents:

DISINFECTION- The destruction or removal of all pathogenic organisms, or organisms capable of giving rise to infection.

Glutaraldehyde / Cidex (2% alkaline NaHCO3):-

It is a high level disinfectant. Especially active against tubercle bacilli,fungi and viruses. Less toxic than formaldehyde. Exposure time: $\geq$ 10hrs.

Phenols:

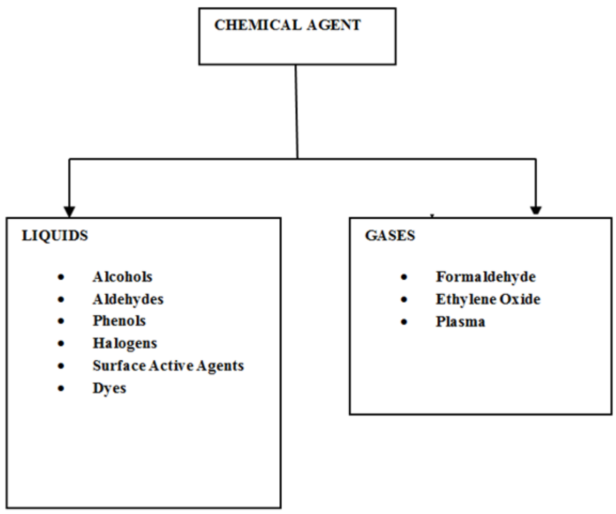
Acts by cell membrane damage thus releasing cell contents and causing lysis**.**Eg. Cresol (LYSOL) ,chlorhexidine (SAVLON),chloroxylenol (DETTOL) and hexachlorophen. Phenol is commonly found in mouthwashes, scrub soaps and surface disinfectants. Low efficiency disinfectant

Halogens :

Bleaching powder or hypochlorite solution mostly used disinfectant for HIV infected material. In concentration of 0.05 or 0.5% used for surface material and instruments disinfection. Should be prepared daily because of instability of sodium hypochlorite solution.Active against bacteria, spores, fungi and viruses (HB, HIV)

Iodophors & Iodine

Active against bacteria, spores & some viruses & fungi. (7.5% Povidone+iodine= Betadine)



METHODS OF DISINFECTING IMPRESSIONS

Spraying
Immersion

Disinfection of Alginate Impressions

0.5% sodium hypochlorite.
Iodophors
Immersion disinfection for prolonged periods will cause distortion due to imbibition [12]

Agar- Reversible Hydrocolloid

Found to be stable when immersed in 1:10 dilution sodium hypochlorite or 1:213 iodophor.
Recommended immersion time is 10 minutes.[13]

Zinc Oxide Eugenol

Immersion in 2% glutaraldehyde
Iodophors or Chlorine compounds.
Adverse effect have been reported on ZOE immersed for 16 hours in diluted hypochlorite.[7]

Impression Compound

Immersion in 1:10 dilution sodium hypochlorite or iodophor for specified time period.[14]

ELASTOMERIC IMPRESSION MATERIALS

Polysulphide and Addition Silicone:

Glutaraldehyde, Iodophor, 0.5% sodium hypochlorite should be used.[15]

Polyether:

Spraying in iodophor, 0.5% Sodium hypochlorite should be used.

Prolonged immersion causes some distortion.

Polyether shows dimensional changes on immersion in 2% glutaraldehyde. [3]

Impression material	Disinfecting agent
Alginate Impressions	0.5% Sodium hypochlorite or Iodophor
Agar	1:10 dilution Sodium hypochlorite or 1:213 Iodophor.
Zinc Oxide Eugenol	2% Glutaraldehyde Iodophors or Chlorine compounds.
Impression Compound	1:10 dilution Sodium hypochlorite or Iodophor
Polysulphide and Addition Silicone	Glutaraldehyde, Iodophor, 0.5% Sodium hypochlorite
Polyether	Iodophor, 0.5% Sodium hypochlorite

INFLUENCE OF DISINFECTING AGENTS ON SURFACE DETAILS AND DIMENSIONAL STABILITY:

Gelson Luís Adabo et al investigated the effect of disinfection methods on the dimensional stability of 6 elastomeric materials. Impression materials were submitted to the following treatments: immersion in 5.25% sodium hypochlorite solution for 10 minutes, immersion in 2% glutaraldehyde solution for 30 minutes, and no immersion (control). After treatments, impressions were poured, and respective stone casts were measured with a Nikon Profile projector and compared with the master model. The elastomeric materials had different reproduction capacities, and the disinfecting treatments did not differ from the control.

David G. Drennon et al examined improved gypsum casts for surface roughness and line-detail reproduction after the immersion disinfection of elastomeric impression materials in an acid glutaraldehyde, an alkaline glutaraldehyde, and a phenol. Impressions were made of a surface roughness standard (R, = 3.08 pm) that was custom made to include engraved grooves.Mean surface roughness (R.) values for all casts of all combinations of disinfectant treatments, impression materials, and improved gypsum stones were obtained with a surface analyzer. Untreated impressions served as controls. Data examined by an analysis of variance indicated that the addition silicone and polyether impression materials provided a surface roughness similar to the precision displacement specimen standard. The acid glutaraldehyde disinfectant demonstrated enhanced line-detail reproduction compared with the standard. Addition silicone and polyether impression materials combined with the acid glutaraldehyde provided the model system closest to the mean surface roughness of the reference standard. These combinations revealed differences in the surface roughness reproduction among the represented improved dental stones.

Glen H . Johnson evaluated the accuracy and surface quality of stone dies made from impressions that had been placed in disinfectants. Measurements were made on stone casts for three clinically relevant dimensions. In addition, the surface quality of the dies was evaluated. Results indicated that selection of the type of impression material is more important than selection of the disinfectant. Addition silicone and polysulfide impressions were disinfected without a loss in accuracy, whereas polyether impressions were adversely affected. The surface quality of dies was acceptable with disinfection and one disinfectant contributed to an improvement in surface quality compared with the control.

Xavier Lepe rt al evaluated advancing contact angle, receding contact angle, imbibition and mass loss of a polyether impression material, and two different viscosities of an addition silicone impression material after long-term immersion disinfection (18 hours). The brand names of the impression materials tested were Impregum F, Extrude Extra, and Extrude Wash, and all were tested by use of the Wilhelmy technique; first, for the non disinfected state, which served as controls, and then after 1 and 18 hours of disinfection in a full-strength solution of acid glutaraldehyde. Weight changes before and after the disinfection process were also measured to detect weight loss and mass change over time. All materials exhibited some degree of imbibition. Polyether lost 0.4% mass in air, which indicated loss of a volatile component. Polyether and addition silicone were both relatively hydrophobic and could be disinfected with acid glutaraldehyde for up to 18 hours without affecting wettability.

Alain Thouati, et al assess the influence of three disinfectant solutions on the dimensional accuracy of seven elastomeric impression materials. Impressions of a test block were either left untreated (controls) or treated by immersion in a disinfectant solution. Measurements were taken on die stone replicas of the impressions. Comparisons were made between (1) the measurements for the variations in the non treated impressions and those for the treated impressions and (2) measurements for the treated impressions and the test block. Results indicated that the aminoamphoteric agent or glutaraldehyde derivative-based solutions created little change in relation to the initial dimensional accuracy of the impression products. However, the sodium hypochlorite solution often leads to expansion by comparison with controls. By comparison to the test block, this expansion then makes it possible in most cases to obtain better dimensional accuracy than initially. Within the limits of this study this expansion could lead to an improvement in clinical fixed prosthodontic procedures.

MaryP.Walker et al evaluated the effect of disinfection on surface quality and dimensional stability of more recent, reformulated vinyl poly siloxane (VPS) and polyether (PE) materials. Using ANSI/American Dental Association (ADA) specification 19 protocols, 50 impressions of stainless steel dies were made with each material. Ten impressions of each material were randomly assigned to a treatment group: (1) no disinfectant; (2) 10-minute dual phenol immersion; (3) 1-hour dual phenol; (4) 10-minute sodium hypochlorite (NaOCl); and (5) 1-hour

NaOCl.Impression surface quality immediately after disinfection was categorized as smooth/shiny ,matte ,or wrinkled/sticky. Dimensional stability was evaluated by measuring dimensional accuracy according to specification 19 after 24-hour, 1-week, and 2-week storage at ambient laboratory conditions. The PE material surface quality was significantly affected (Pearson Chi-square, $p \leq 0.05$) by NaOCl with a mottled surface on 30% of the impressions after 10-minute immersion and a matte/sticky surface on 100% of the PE impressions after 1-hour immersion. Separate 2-factor analyses of variance (ANOVA) and Bonferroni post hoc tests of dimensional accuracy within each material indicated a significant difference ($p \leq 0.05$) between non-disinfected and disinfected PE impressions, which exhibited expansion. There were also significant differences ($p \leq 0.05$) in both VPS and PE dimensional accuracy as a function of measurement timerelated to increasing shrinkage over time in non-disinfected and disinfected impressions. Despite PE expansion following disinfection and continued shrinkage of both the nondisinfected and disinfected VPS and PE impressions over a 2-week period, all dimensional accuracy measurements met the ADA standard, ≤0.5% dimensional change. Based on this evidence, neither NaOCl nordual phenol disinfectants used for varying time periods adversely affected the dimensional stability of the more recent formulations of VPS and PE; however, Impregum PentaSoft PE surface quality appeared to be adversely affected by increasing exposure to NaOCl.

CONCLUSION

Selection of the type of disinfectant for impressions is very important as it can induce changes in accuracy and detail . The addition silicone impressions in combination with any disinfectant other than the neutral glutaraldehyde produced casts with excellent accuracy. Polysulfide impressions can also be used successfully with disinfectants, but polyether impresions were not suited for disinfection by immersion. The acid-potentiated glutaraldehyde can contributed to an improvement in surface quality of stone dies . However, the surface quality was acceptable for all combinations of impression materials and disinfectants and hence disinfectants should be used in impressions prior to cast pouring..

REFERENCES

1. Melilli, D., Rallo, A., Cassaro, A. and Pizzo, G., The effect of immersion disinfection procedures on dimensional stability of two elastomeric impression materials.*J Oral Sci. 2008, 50(4),441-446*
2. Adabo, G.L., Zanarotti, E., Fonseca, R.G. and dos Santos Cruz, C.A., Effect of disinfectant agents on dimensional stability of elastomeric impression materials. *J Prosthet Dent. , 1999, 81(5),621-624.*
3. Drennon, D.G. and Johnson, G.H., The effect of immersion disinfection of elastomeric impressions on the surface detail reproduction of improved gypsum casts. *J Prosthet Dent. 1990, 63(2),233-241.*
4. Johnson, G.H., Drennon, D.G. and Powell, G.L., Accuracy of elastomeric impressions disinfected by immersion. *J Am Dent Assoc 1988, 116(4),525-530.*
5. Craig, R.G., Review of dental impression materials. *Adv Dent Res1988. 2(1),.51-64.*
6. Müller, J., Götz, G., Hörz, W. and Kraft, E., An experimental study on the influence of the derived casts on the accuracy of different recording materials. Part I: Plaster, impression compound, and wax *J Prosthet Dent. 1990 63(3),263-269*
7. Olsson, S., Bergman, B. and Bergman,M., Zinc oxide-eugenol impression materials. Dimensional stability and surface detail sharpness following treatment with disinfection solutions *Swed Dent J.1982, 6(4),177.*
8. Olsson, S., Bergman, B. and Bergman,M., Agar impression materials, dimensional stability and surface detail sharpness following treatment with disinfectant solutions. *Swed Dent J. 1987, 11(4),169-177.*
9. Bergman, B., Bergman, M. and Olsson, S., Alginate impression materials, dimensional stability and surface detail sharpness following treatment with disinfectant solutions. *Swed Dent J. , 1984, 9(6),255-262.*
10. Skinner, E.W. and Cooper, E.N., Desirable properties and use of rubber impression materials. *J Am Dent Assoc 1955 , 51(5),523-536.*
11. Braden, M., Causton, B. and Clarke, R.L., A polyether impression rubber. *J Dent Res 1972, 51(4),889-896.*
12. Beyerle, M.P., Hensley, D.M., Bradley Jr, D.V., Schwartz, R.S. and Hilton, T.J., . Immersion disinfection of irreversible hydrocolloid impressions with sodium hypochlorite. Part I: Microbiology. *Int J Prosthodont.1994, 7(3),234-8*
13. Giblin, J., Podesta, R. and White, J., Dimensional stability of impression materials immersed in an iodophor disinfectant. *Int J Prosthodont. 1990, 3(1). 72-7*
14. Bhat, V.S., Shetty, M.S. and Shenoy, K.K., Infection control in the prosthodontic laboratory. *J Indian Prosthodont Soc 2007, 7(2),62.*
15. Thouati, A., Deveaux, E., Iost, A. and Behin, P., Dimensional stability of seven elastomeric impression materials immersed in disinfectants. *J Prosthet Dent. 1996, 76(1),8-14.*
16. Lang, B.R., Lepe, X., Johnson, G.H. and Berg, J.C., Surface characteristics of polyether and addition silicone impression materials after long-term disinfection. *J Prosthet Dent,1995, 74(2),181-186.*
17. Walker, M.P., Rondeau, M., Petrie, C., Tasca, A. and Williams, K., Surface quality and long-term dimensional stability of current elastomeric impression materials after disinfection. *J Prosthodont. 2007, 16(5),343-351*