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Disinfection of elastomeric impression materials with Ozone, UV radiation, Microwave, and Glutraldehyde

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Abstract

The current research was conducted to compare ozone, UV radiation, microwave and glutraldehyde method of disinfection of impression materials. The present study comprised of 44 condensation silicone impression materials which were disinfectant with 2% glutraldehyde, UV radiation, ozone and microwave method. The pre and post bacterial count was assessed. The pre-microbial contamination mean in CFU for all groups was 352.3 in group A, 345.6 in group B, 337.4 in group C, and 342.4 in group D ($P>0.05$). The average post-microbial contamination was 62.4 in group A, 67.4 in group B, 132.5 in group C, and 24.4 in group D. After applying a one-way ANOVA test, it was shown that there was a significant difference ($P<0.05$) in CFU across all groups. Pre- and post-microbial CFI differed significantly across all groups. Group D showed the greatest reduction, which was then followed by groups A, B, and C. After applying a one-way ANOVA test, it was shown that there was a significant difference ($P<0.05$) in CFU across all groups. It was determined that the impression material could be disinfected more effectively using ozone, glutaraldehyde, and UV light than using a microwave.

Keywords: Disinfection, glutraldehyde, impression, microwave, ozone, UV Radiation.

Full length research article *Corresponding Author, e-mail:babajipedo@gmail.com

1. Introduction

The majority of dental procedures require the creation of dental impressions [1]. In order to accomplish a flawless adaptation, the permanent prosthesis should be built using a correct positive reproduction of the patient's oral structures, which can be established from a negative copy of their anatomical structures [2]. Oral fluids like blood and saliva can contaminate impression materials. If this impression material is handled carelessly, the person handling it could become contaminated. Dental labs and clinics have a probability of contracting the same infection [3]. Although it has long been practised to rinse dental impressions under running water to get rid of blood and saliva, the dentistry community has not approved of any regular procedures for sterilising or disinfecting dental impressions [1]. In order to prevent cross-infection, the Dental Association (ADA) and the Centres for Disease Control advised disinfecting the impressions [4]. Therefore, it is recommended to disinfect imprint materials. There are numerous ways to disinfect objects, including immersing them in chemical disinfectant, autoclaving, using radiation, using herbs, etc. [5]. Greater harmful microorganism

reduction should be demonstrated by the disinfection solution without compromising the material's dimensional stability or capacity to mimic certain details [6].

Three types of disinfection exist: low level disinfection has limited antimicrobial activity, intermediate level disinfection includes the destruction of microorganisms like tubercle bacilli, and high level disinfection includes the inactivity of bacterial spores and other microbial forms [7]. While numerous studies have supported different approaches to the disinfection process, the immersion method is thought to be more successful since it ensures that the disinfectant solutions are applied to all surfaces of the impression and tray [2,8]. The biocompatibility of the disinfection solutions used on dental impression materials, such as alginate or elastomeric silicone, is especially concerning because these materials carry a risk of microbial colonisation and infection [9].Because it is too risky to heat or steam sterilise impressions and occlusal data, chemical disinfection has remained a frequent practical method for getting rid of bacteria. Nonetheless, it is advised to only immerse materials for a little amount of time—less than 30 minutes—because all disinfection solutions have the potential to significantly alter the dimensional alterations of imprint materials [9]. Alternative methods of disinfection are tried, but chemical disinfectants have a short shelf life and need to be made freshly [10]. The most well-known dental impression disinfecting solutions are glutaraldehyde, phenols, iodophors, sodium hypochlorite, and chlorhexidine digluconate. Furthermore, new disinfection techniques have been developed, including the use of microwaves, autoclaving, and ultraviolet (UV) light chambers. The method of disinfection shouldn't affect the impressions—that is, it shouldn't result in surface dimensional changes [11].The use of ultraviolet rays can be a good alternative choice for disinfection because Ultraviolet (UV) rays have long been recognized as an effective method for eliminating microorganisms without requiring chemicals or heat [1]. UV radiation combines with cell DNA to cause cell death, which has a potent bactericidal effect [11]. At 24 watts (3750 µw/cm2), the greatest death efficiency under UV light exposure has been achieved [10].Ozone, having the chemical formula O3, is an inorganic gas. O2 is more stable than it is. Vital proteins and cell membranes are impacted by ozone [10].

Microwave disinfection is an effective and versatile method, which is quick, easy, and inexpensive method. Microwave energy is converted into heat by polar molecules moving kinetically over an extended period of time in a thermal action. Microwaves are responsible for antimicrobial action by disrupting the cell membrane integrity and cell metabolism of microbes [10].The present study was conducted to compare ozone, UV radiation, microwave and glutraldehyde method of disinfection of impression materials.

2. Materials and Methods

The present study was performed in the department of Prosthodontics. It comprised of 44 condensation silicon impression materials. The ethical approval was obtained from, institutional ethics committee. The study was done by single trained investigator. Four groups were made; Group A-Ozone, Group B- radiation, Group C-Microwave, and Group D- Glutraldehyde Following the use of condensation silicone substance for the maxillary imprint, each disinfectant was applied to the entire impression. After the immersion period was over, a post-immersion swab was extracted from the condensation silicone dental impression and submitted to microbiological evaluation. Nutrient agar was employed as a medium to encourage the development of microorganisms. The diluted samples were evenly distributed across the Petri plates holding the nutritional agar using the pour plate technique. Following inoculation, these Petri plates underwent a 24-hour incubation period at 37°C. Using a digital colony counter on a petri dish, the total number of colony forming units (CFUs) of the viable microorganisms after incubation was counted and recorded. A comparison was made between the pre and post disinfectant counts.The result thus obtained was assessed using SPSS version 23 (IBM. Chicago, USA). The total viable count was expressed as mean and standard deviation (SD). One-way ANOVA and t test was used to compare pre and post disinfectant CFU in all groups with p value significance at 0.05.

3. Results and discussion

Mean pre microbial contamination in group A was 352.3, in group B was 345.6, in group C was 337.4 and in group D was 342.4 (P> 0.05) in CFU in all groups. Mean post microbial contamination in group A was 62.4, in group B was 67.4, in group C was 132.5 and in group D was 24.4. One-way ANOVA test was applied which revealed significant difference (P< 0.05) in CFU in all groups (Table-1). There was significant difference in pre and post microbial CFI in all groups. Maximum reduction was observed in group D, followed by group A, B and C. One-way ANOVA test was applied which revealed significant difference (P< 0.05) in CFU in all groups.

Cross infection is the transition of an infectious cause from one individual to another in a clinical condition [12]. For dental practitioners, transmission of hepatitis virus is the major occupational hazards. Moreover, HIV can be transmitted by transfusions, needle stick injury [13].Sahoo et al. examined the disinfection of imprint materials using glutraldehyde, UV light, herbal remedies, and autoclaving. They came to the conclusion that autoclaving is a more effective sterilisation technique than using glutraldehyde, UV light, or herbal disinfectants [3]. Purohit et al. used gaseous ozone, UV radiation disinfection, and 2% gluteraldehyde to assess the effectiveness of disinfection on elastomeric imprint material. They came to the conclusion that impressions can be successfully disinfected with dry gaseous ozone without compromising their dimensional stability [1]. After disinfecting ozone water, Abinaya et al. assessed the silicone impression materials' surface quality. They came to the conclusion that, for addition silicone putty, light body, and medium body impression materials, ozone water disinfection changed the least when compared to 5.25% sodium hypochloride and 2% glutaraldehyde disinfection [2]. When two elastomeric impression supplies—VPS and PE—were submerged in two distinct disinfectants, Almuraikhi et al. discovered that there were very minor dimensional alterations [14]. Herbal mouthwash was shown by Nagi et al. to be just as effective at disinfecting condensation silicone impressions as chlorhexidine and sodium hypochlorite [15].

Table 1: Comparison of the pre- and post-disinfection microbial contamination in different groups

Group	Mean (106 CFU/ml)		t	Dt	P
	pre	post			
Group A Ozone	352.3	62.4	10.67	2	0.01
Group B UV radiation	345.6	67.4	12.31	2	0.01
Group C Microwave	337.4	132.5	9.87	2	0.05
Group D Glutraldehyde	342.4	24.4	12.21	2	0.001

One-way ANOVA, $p < 0.05$, significant

We found effective disinfection of impression material with ozone and UV radiation comparable with gluteraldehyed solution. Further studies are needed to validate the results.

4. Conclusions

It was concluded that glutaraldehy, ozone and UV radiation method of disinfection of impression material compared to microwave method of disinfectant.

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