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KNOWLEDGE AND PRACTICE ON DISINFECTION OF DENTAL IMPRESSIONS AMONG DENTISTS AND DENTAL TECHNICIANS

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ABSTRACT

Background: Dental impressions are a common source for transmission of infection between dental clinics and dental labs. Dental impressions can be cross-contaminated by patient's saliva and blood, which then cross-infect the dental casts poured from the impressions.

Aim of the study: To evaluate the current practices of disinfection of dental impressions and their protocols and to assess the knowledge of cross-infection control among dentists and dental technicians.

Materials & Methods: A self-administered questionnaire will be distributed to dentists and dental technicians about their practices of disinfection for dental impressions. , the questionnaire consists of two separated parts, one is concerned with dentists and the other with dental technicians. Data were collected from forty dentists and twenty dental laboratory technicians.

Results: According to our findings, only 32.5% of dentists had an infection control by mean of disinfection of impressions, 67.5% of them were not care about disinfection of impressions. In the other hand, 70% of respondent's dental technicians follow a protocols of impressions disinfection, the other 30% were not interested in disinfection of impressions or casts.

Conclusion: Dentists practices in impression disinfection was not satisfactory, therefore, education programs about impression disinfection are needed. Unlike dentists, dental technicians had a better knowledge and practice about disinfection of dental impressions.

KEYWORDS: Dental impression, disinfection, dental technician.

INTRODUCTION

Dental impressions, which are used to create a negative form of the human dentition are a crucial prerequisite for the successful manufacturing of different types of oral appliances. Based on the dental impressions, three-dimensional replicas of intraoral situation are created in order to serve as working analogs used for the final work manufacturing. A high-quality dental impression provides the technician with the possibility of fabricating a more precise dental prosthesis exactly match the oral conditions of each patient [(1)].

As dental impressions are taken intraorally by dentists and then must be transported to the dental laboratory technician, impressions must be considered as a potential source of infection in dental practice. This approach is justified by the fact that, on average, oral tissues are colonized with about 280 bacterial species, and 1 mL of a healthy person's saliva contains approximately 750 million microorganisms [2].

Dental impressions contaminated with the patient's saliva and blood may cross-infect the dental casts poured from them [3]. Contaminated impressions and casts thus become tools for the transmission of both bacteria and viruses between clinics and dental laboratories [4]. In addition, casts poured from impressions can carry microorganisms and these may perhaps spread to other parts of the dental laboratory during the trimming of the casts or dies [5].

According to G. L Powell, 67% of materials sent from dental offices to labs were found to be contaminated with Streptococci, Staphylococci, Candida species ,or P .aeruginosa [6]. Studies have also shown that microbes of tuberculosis and hepatitis B can live for up to seven days or more at room temperature (7, 8). As well, the risk of hepatitis B infection among dental professionals is five to 10 times higher than that of the general population [9].

The responsibility of dental health-care ensures that all surfaces and devices, including dental impression materials, are adequately cleaned, disinfected, and sterilized to prevent cross-contamination and exposure to blood- and saliva-borne diseases. In most cases, impressions are left under running tap water to get rid of blood and saliva. Rinsing impressions under running water as soon as they're removed from a patient's mouth was standard practice for sanitization up until 1991. Numerous studies since then have shown that such a technique can only eradicate 40% of bacteria, fungi, and viruses, meaning the risk of infection remains considerable [10, 11].

Several disinfection methods are used to disinfect different impression materials. The most common method is chemical disinfection, wherein the impression surface is treated chemically, either by immersion or spraying. Many chemical disinfection materials are commercially available in different compositions and concentrations, for e.g., glutaraldehyde, sodium hypochlorite (NaOCl), hydrogen peroxide, iodophor, phenol, and chlorine compounds [12].

Among these materials, glutaraldehyde It is a high-level disinfectant and is available in neutral, alkaline and acidic forms [13]. It is a broad-spectrum chemical agent with fast killing capability. It is also called chemo sterilizer. If it is used in proper concentration and specialized equipment, it can destroy all types of micro-organisms including bacterial and fungal spores, tubercle bacilli and viruses [14]. It is a colorless liquid with pungent odor. Although it is considered as the best disinfectant for cold sterilization of medical equipment, it also has many health hazards including irritation to skin, eyes and respiratory tract. It is a sensitizer of skin and respiratory tract, so special precautions are needed while using it [15].

Sodium hypochlorite (NaOCl) provides intermediate level disinfection and has a broad-spectrum antimicrobial activity. It is very useful disinfectant with advantages including fast bactericidal activity, ease of use as it is soluble in water, relatively stable, nontoxic at use concentrations, low cost, non-staining, noninflammable and colorless. Disadvantages include mucous membrane irritation, less efficient in organic environment and corrosive effect on metals [16]. According to one study, alginate impression disinfected with spray method using 1% NaOCl did not show any severe dimensional changes or surface roughness of stone model that were fabricated from that impression [17]. However,

in another study impression disinfection by immersion method with 0.5% NaOCl for 15 min exhibited small dimensional change [18].

Complex phenols are classified as intermediate level disinfectants. These are also known as protoplasmic poisons. At low concentration, they cause lysis of rapidly growing E. coli, staphylococci and streptococci. They possess antifungal and antiviral properties as well [19]. Ideally not recommended for impression disinfection as simple phenols are low level disinfectants. They are incompatible with latex, acrylic, rubber and cause acute toxicity as well [20].

Chlorhexidine is an intermediate level disinfectant and antiseptic. It has broad spectrum of activity and also used as preservative. It is commonly used in hand washes and oral products. It is bactericidal, veridical and mycobacteriostatic. Its activity declines in the presence of organic matter because its activity depends on specific pH [19]. 2% chlorhexidine has shown activity against s. aureus, E. coli, Bacillus subtilis, but no antifungal activity was seen in agar diffusion test at low concentration.0.2% chlorhexidine disinfectant solution can be used as water substitute in alginate mixing. Impression can also be immersed in chlorhexidine solution and it causes effective disinfection [21]. According to one study, 1.0 g/L chlorhexidine solution can be used to produce self-disinfecting alginate impression material for clinical use. In this way, it has shown antimicrobial activity and did not cause any changes in dimensional accuracy, flow ability and setting time of irreversible hydrocolloid impression material [22, 23].

Other methods are used as alternative to chemicals such as microwave disinfection, is an effective and versatile approach that is fast, easy to use, economical, and easily performed by dentists, dental assistants, and technicians. This technique impairs cell membrane integrity and cell metabolism, leading to microbial death. Currently, this method is employed in the effective disinfection of dentures [24].

Ultraviolet light is recommended as a suitable disinfection method for impressions as it doesn't affect its dimensional stability [25]. Time, intensity, humidity, and contact of UV from the microorganisms all impact disinfection efficacy. Since dental impressions have small crevices and numerous places where microorganisms can thrive, the UV light must be reflected in multiple directions for it to be effective. C.albicans colonies have been shown to dramatically reduce when exposed to UV light with a maximum death efficiency at 24 watts compared to direct-current low discharge. Higher wattage was shown to reduce colony count in an even shorter time [26].

Ozonated water can also be used as impression disinfectant. According to one study, aqueous ozone is more biocompatible than other disinfectant solutions e.g., chlorhexidine, NaOCl, H2O2. Ozonated water can reduce the number of microorganisms on the surface of irreversible hydrocolloid impression materials and by increasing time of immersion more effective disinfection can be achieved [27]. Except for the ongoing development of more efficient disinfectants with strong antibacterial and antivirus properties, great attention is focused on their effect on the impression materials. Previous studies have shown that disinfectants usually containing oxidizing compounds such as peroxosulphates, aldehydes, sodium hypochlorite, iodine compounds, quaternary ammonium salts or organic alcohols can impair the accuracy of the impression materials and their ability to reproduce details of soft and hard tooth tissues.

The most susceptible to this damage were alginate impression materials and polyether's [28, 29]. It is well-known that due to the hydrophilic properties of alginates, water and a high concentration of water-

soluble salts in their structure, they readily absorb water and swell in an aqueous environment. On the other hand, they can exclude water from their surface, the phenomenon known as syneresis, and are subject to water evaporation when they are left in the air, both effects causing their contraction. Similarly, polyether impression materials which are naturally hydrophilic due to the presence of hydrophilic ethylene oxide units in their polymer backbone are susceptible to dimensional changes upon contact with an aqueous solution of the disinfectant [30]. In contrast, addition and condensation silicones are more resistant to the disinfectants as result of their more hydrophobic character [28,29,30].

Although there are a number of publications dealing with the effect of disinfection on dental impression materials, a universal protocol for disinfection of all types of impression materials has not yet been accepted. This is due to the high variability in the chemical composition of disinfectants and impression materials, as well as different protocols used to test the disinfectants antibacterial effectiveness and their effect on the properties of the impression materials [20].

MATERIALS AND METHODS

A pre-formed questionnaire was prepared from two parts, one to the Dentists which consist of 8 questions [Table 1], and the other one to dental technicians consist of 7 questions [Table 2].

The questionnaire was prepared based on language known to the respondents. The questions were prepared to assess the knowledge, attitude, and practices employed for infection control in dental offices and laboratories.

The questionnaire administered to collect information about the methods used to disinfect the impressions and the level of communication between dental clinics and labs.

Data were gathered from dental clinics and laboratories by visiting them and distribute a paper-copy of the questionnaire.

The questionnaire that performed to dentists consisted of 7 close-ended questions and one question with two choices “yes or no”. The questionnaire was divided into three sections, section one about impression material used. Section two about knowledge among dentists in disinfection of impressions. Section three about methods of cast disinfection.

The questionnaire that prepared to dental technicians divided into two sections, the first section about disinfection of impression, the materials used, and the suitable method for disinfection. The second section concerned with casts, whether they got disinfected, the protocol of disinfection, and the materials used.

RESULTS

Questionnaires were returned completed by forty dentists, twenty dental technicians with some missing answers.

According to our investigation there is convergence in use of silicon impression material and hydrocolloid (Alginate), where the ratio (50% ,40%) respectively, and a much less 10% using intra oral scan (Digital impression).

The majority of respondent’s dentists do not take care about disinfection of their impressions 67.5%, they afraid that impressions could not withstand sterilization process and disinfectant materials will

distort fine details that impressions reproduce, just adequate rinsing under running tap water is enough to remove saliva and blood from impression surface.

32.5% of dentists follow a disinfection protocol to sterilize their impressions before pouring or sending to dental laboratory, a large number of dentists use spray method rather than immersion, because they believe that irreversible hydrocolloid (alginate) and hydrophilic silicones exhibit minimal distortion when disinfected in this manner. Spraying by alcohol 69.2%, diluted sodium hypochlorite (NAOH) 23%, and surface disinfect 7.8%.

In the other part of our study, a great number of labs taking care about disinfection of received impressions 70% because they afraid of infection transmission to dental lab staff, and a smaller number of them do not disinfect their impressions 30%.

Unlike dentists, dental labs use immersion method 71.4% more than spray 28.6%, they say that the most effective means of disinfecting impressions is to immerse them in disinfectant solution for 30 minutes.

There is a variety of materials that used to disinfect impressions like glutaraldehyde 35.7%, sodium hypochlorite 21.4%, alcohol 35.7%, and surface disinfectant about 28.6%.

Dental labs who disinfect their casts 37.5% use only two materials which are diluted sodium hypochlorite and surface disinfectant such as Dettol.

Results are summarized below in Table 1 and Table 2.

Table1 *(practice of dentists on impression disinfection.)*

Question	Option	Number	Frequency %	Chi-Square Value	df	P Value	Significance
1. Impression Material of Choice	Silicon	20	50	10.41	2	0.005	
	Hydrocolloid (Alginate)	16	40				Significant
	Digital (intraoral scan)	4	10				
2. Did you disinfect your impressions?	Yes	13	32.5	4.90	1	0.027	Significant
	No	27	67.5				
3. Disinfectant material used?	Alcohol spray	9	69.2	18.20	4	0.001	
	Surface disinfect	1	7.8				
	Immersion in NAOH	0	0				Significant
	Spray by NAOH	3	23				
	Glutaraldehyde	0	0				

Question	Option	Number	Frequency %	Chi-Square Value	df	P Value	Significance
4. If you use the immersion type, what time is used?	1 min	0	0	Not tested			
	10 min	0	0				
	20 min	0	0				
5. Waiting time after spray type should be?	1 min	6	46.2	1.97	2	0.37	Not Significant
	5 min	2	15.4				
	10 min	5	38.4				
6. Where did you learn about impression disinfection?	College	7	53.8	6.48	3	0.09	Not Significant
	Specialized center	1	7.8				
	Reading articles	3	23				
	Reading texts	2	15.4				
7. Better disinfection method of impression	Disinfection of cast	1	7.8	20.36	2	0.0004	Significant
	Disinfect both impression and cast	12	92.2				
	Never disinfect the impression	0	0				
8. Disinfect cast by	Soaking	5	38.4	0.70	1	0.40	Not Significant
	Spray	8	61.6				

Table2 *(practice of dental technicians on impression disinfection.)*

Question	Option	Number	Frequency %	Chi-Square Value	df	P Value	Significance
1. What did you receive?	Impression	20	100	12.5	1	0.0004	Significant
	Cast	8	40				
2. Did you disinfect your impressions?	Yes	14	70	3.2	1	0.07	Not Significant
	No	6	30				
3. Disinfect impression by?	Immersion	10	71.4	2.5	1	0.1	Not Significant
	Spray	4	28.6				
4. Disinfectant material used?	Glutaraldehyde	5	35.7	0.6	3	0.8	Not Significant
	Sodium hypochlorite (NAOH)	3	21.4				
	Alcohol	5	35.7				

Question	Option	Number	Frequency %	Chi-Square Value	df	P Value	Significance
	Dettol	4	28.6				
5. Did you disinfect casts?	Yes	3	37.5	0.5	1	0.4	Not Significant
	No	5	62.5				
6. Disinfect cast by?	Soaking	2	66.6	0.3	1	0.5	Not Significant
	Spray	1	33.4				
7. Disinfectant material used for casts?	Glutaraldehyde	0	0	0.3	4	0.5	Not Significant
	Povidone-iodine	0	0				
	Chlorhexidine	0	0				
	Sodium hypochlorite (NAOH)	1	33.4				
	Dettol	2	66.6				

DISCUSSION

It is evident that microorganisms causing disease are present in human blood and saliva. Contact with blood or saliva mixed with blood may transmit pathogenic microorganisms. Thus, care should be taken while taking impressions. Cross infection control is the most significant and important among dental workers. Cross infection is the transfer of an infectious agent from one individual to another in a clinical environment [28]. New infectious diseases have been found causing cross infection. Impression with different impression materials accelerates the rate of infection transfer. Dental staff including hygienists is at higher risk of getting exposed to infectious agents such as AIDS, hepatitis, herpes simplex, and cytomegalovirus [28].

It has been shown that just rinsing impressions under running tap water is insufficient to remove microbes but it may spread them over the surface of the impression material. Disinfection is therefore required [29]. Spray disinfectants have been introduced which can provide good disinfection and avoid the problems associated with immersion techniques such as adverse effects on dimensional stability [30].

Depending to our study, high percentage of dentists have insufficient knowledge about sterilization of impressions before sending to dental labs, they believe that there is no need to disinfect the impressions and rinsing with water is enough to remove saliva and blood.

On assessment of awareness among dental technician regarding infection control measures, it was found that 70% participants were aware and employ infection control practices in dental laboratory.

CONCLUSION

In the limits of our study, the results observed allowed the following conclusions: practices and awareness of dentists regarding cross-infection control are less than ideal, and this might increase the risk of transmission of diseases. The findings show that there is better infection control among dental technicians. Therefore, there is aneed for increasing awareness and establishing educational programs for both groups to decrease the risk of transmission of diseases.

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