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PILOT STUDY ON THE MANIPULATIVE CHARACTERISTICS OF ALGINATE POWDERS MIXED WITH THREE DIFFERENT DISINFECTANT LIQUIDS

Dental Science

Dr. Merin Mathew* Assistant professor Department of Prosthetic Dental Science, College of Dentistry, Al Jouf University, Saudi Arabia.* Corresponding Author

Dr. ShitalSonune Lecturer Department of Prosthetic Dental Science, College of Dentistry, Al Jouf University, Saudi Arabia

Abdulaziz Fawaz H Aldahash 5th BDS Department, College of Dentistry, Al Jouf University, Saudi Arabia

Ahmed Muharraq Gillan Alruwaili 5th BDS Department, College of Dentistry, Al Jouf University, Saudi Arabia

Bndar Fayez J Alruwaili 4th BDS Department, College of Dentistry, Al Jouf University, Saudi Arabia

Marwan Sulaiman J Alhassan 4thBDS Department of Prosthetic, College of Dentistry, Al Jouf University, Saudi Arabia

ABSTRACT

In search of developing a self disinfecting alginate impression material, the present study conducted to evaluate the mixing characteristics of commercially available alginate dental impression material with three distinct disinfectant solutions. Four commercially available alginate powders were selected as A: Tropicalgin, B: Cavex CA 37, C: KROMOPAN, D: United Alginate. Disinfectant solutions also were selected as I: Isopropyl alcohol 70%, II: Hydrogen peroxide- 6%, III: Povidone- Iodine- 10%. The mixing procedure was standardized by choosing a consistent manufacturer recommended powder to liquid ratio for all type of test materials. From the result obtained, it is observed that consistency suitable for impression making was obtained only with 6% hydrogen peroxide and 10 % povidone iodine for all types of alginate powders. A sandy like consistency, which is not suitable for dental impression, was obtained with isopropyl alcohol for all four types of alginates.

KEYWORDS

Alginate, Impression Material, Disinfection, Consistency

1. Introduction

Irreversible hydrocolloid impression material, alginate is developed in the year 1930s and has been a "material of choice" for making diagnostic and/or primary impression since ages [1]. Alginate is common due to the ease in manipulation and cost effective with acceptable degree of accuracy. However, hydrocolloid impression materials show imbibition of blood and saliva, which can cause infectious impression [2]. These contaminated alginate impressions may spread infectious disease such as hepatitis B, tuberculosis, herpes and AIDS to the persons involved in handling the same [3]. Therefore, it is recommended to disinfect all surfaces that splashed or touched with human body fluids [4]. Disinfection procedures such as disinfectant immersion/ spraying is usually employed to eliminate possible routes for transmission and cross contamination of the infectious diseases [2-5]. Alginate is prone to distortion after conventional disinfection procedure. Therefore, mixing of disinfectants becomes an alternative to eliminate the spraying or immersion technique and thereby avoiding the dimensional changes that can occur due to the imbibition of disinfectant solution during disinfection procedure [5].

Disinfection refers to the destruction of pathogenic organisms physically or chemically. A variety of disinfectants are available for destroying the pathogenic microorganisms of dental impression by immersion or spraying technique [6]. However, the effect of mixing these disinfectant solutions with alginate powder have not studied much. Therefore, the present study focussed on the manipulative characteristics of some of the competent disinfectants employed in dentistry.

2. Materials & Methods

2.1 Materials

Four commercially available alginate powders and disinfectant liquids were taken as A, B, C, D and I, II, III

A: Tropicalgin (Lot no. 193014, Zhermack clinical, Itali),
B: Cavex CA 37 (Lot No. 150501, Cavex Holland BV, Holland)
C: KROMOPAN (Lot No. 225451, Vannini Dental industry, Itali)
D: United Alginate (Lot No. EOT 243D0, Major prodotti Dentari SpA. Itali)

I: Isopropyl Alcohol 70% (Batch No.9N628B9, Greencross incorporated, Philippines)
II: Hydrogen Peroxide- 6% (Batch No. 08001116, Suncare Pharma, KSA)
III: Povidone- Iodine- 10% (Batch No. 70100 Avalon Pharma, KSA)

2.2 Methods

Control and test groups were set for the study. Water chose as the liquid medium for control group. Three different types of commercially available disinfectants (I, II &III) were considered as the liquid mediums for test groups. Rubber bowl and curved stainless steel spatula used for manipulation. Plastic measuring scoop and cylinder opted for the proper measurement of powder and liquid. The ratio was taken as 7.5gm powder and 24ml of liquid as per the manufacturer recommendation. The mixing qualities of all four different types of alginate powders with control and test solutions were established. An ideal mix of alginate would be smooth creamy and will not drip off from the spatula when the mix is raised [7], resultant mixes were graded as follows by observing the final mix. 2= Excellent (glossy surface and no dripping material out of spatula), 1= good (no glossy surface and no dripping), 0= bad (sandy consistency)

3. Results:

Figure 3.1 Quality of the final mix of control and test groups

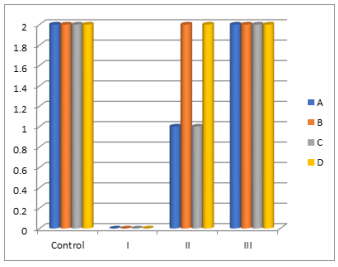

Figure 3.2 Consistency obtained for control and test group I

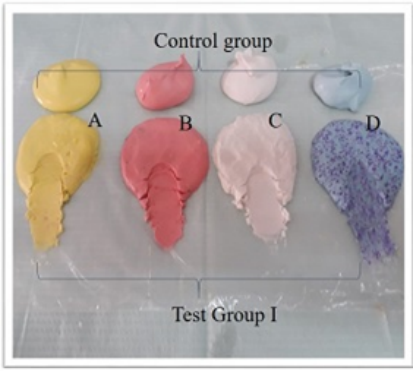

Fig 3.1 Describes as follows

Control Group:
Excellent mixing qualities observed with all different types of alginate powders and water, thus graded 2.

Test groups:

I: Isopropyl alcohol 70 %:
Isopropyl alcohol was unable to mix appropriately with all four types of alginate powders selected in the present study. It resulted in a sandy mix, thus graded 0. (Figure 3.2)

II: Hydrogen peroxide 6%:

A: Immediately after mixing, the powder was unable to get dissolved in the solution, but after 90 seconds, powder started dissolving, it resulted in a smooth mix without glossy surface. It graded 1.

B: Excellent mixing qualities were observed, thus graded 2.

C: Initial dissolution of powder in the liquid was less, but later resulted in a smooth mix, graded 1.

D: A smooth, glossy and creamy consistency was observed, thus graded 2.

III: Povidone Iodine 10%: with Povidone iodine all types of alginates (A, B, C & D), a smooth, glossy and creamy consistency obtained, thus graded 2

4. Discussion:
Disinfectants can act on microorganisms in two ways such as growth inhibition and lethal action. Lethal actions may be bactericidal, fungicidal or viricidal. Lethal effects are of interest in disinfection [8]. Isopropyl alcohol often called isopropanol is one of the disinfectant fully active against lipid viruses which makes them effective against lipid wrapped viruses such as HIV and hepatitis A. but less active against nonlipid enteroviruses. Thus, it is classified as intermediate level disinfectant. This is inexpensive and easy to handle. [6].

6% Hydrogen peroxide found to be an effective disinfecting solution in eliminating microorganisms [9]. It affects mainly on the bacterial cell by producing enzymes which either destroy the oxidizing agent before bacterial degradation takes place [8]. It is a widely accepted antimicrobial chemical having proven action against bacterial spores and protozoal cyst; it possesses flexibility in use and safety profile [10]. Povidone Iodine otherwise called iodopovidone is one of the best antiseptic solutions, which has a broad-spectrum microbicide that destructs microbial protein and DNA particularly effective against *staphylococcus aureus* and *staphylococcus feacalis* [11, 12]. It can act against actinobacillus, actinomycetemcomitans, porphyromo nasgingivalis and other periodontal pathogens [13-15]. Iodine mainly acts by interfering at the level of respiratory chain of the microorganism by blocking the transport of the electrons through electrophilic reaction with the enzymes of the respiratory chain. It can kill candida strain in 10-20 seconds [8]. Povidone Iodine reduces the microbial contamination especially effective in surgical site infection [12]. The present study utilized isopropyl alcohol, hydrogen peroxide and povidone Iodine as the disinfectant liquid medium for mixing alginate.

Isopropyl alcohol mixes were sandy rather than a smooth mix. The mixed material was dragged using spatula to show the sandy consistency in Figure 3.2. Alginate powder consists of sodium or potassium salts of alginic acid which is soluble in aqueous, organic or aqueous-organic media [16-17]. Isopropyl alcohol is a colourless, volatile liquid has three carbon, eight hydrogen and one oxygen atoms ($CH_3CHOHCH_3$) [6]. The solubility of alginate in a solvent is highly depends on pH, ionic strength and gelling strength of the solvent [16-17]. However, it is reported that if the alcohol content is more than 30 % in the liquid medium, alginate powder cannot get dissolved. Alginate shrinks at high pH. Therefore, no ions will be released for the reaction to occur [18]. The present study agrees with this concept because all four varieties of alginate were unable to mix well with isopropyl alcohol (Figure 3.2).

Hydrogen peroxide is a very pale blue liquid becomes colourless in dilution. It is slightly more viscous than water. It is a weak acid and has strong oxidizing properties. Unstable hydrogen peroxide gets decomposed readily as oxygen and water with release of heat accelerated the reaction procedure and a smooth mix obtained in the present study upon spatulation indicates the possibility of mixing alginate impression material with hydrogen peroxide disinfectant liquid [8-10].

Povidone Iodine 10% comprises 90% of water and 8.5% povidone and remaining iodine [19]. The result obtained implies that povidone iodine liquid mixes similar to that of control group may be due the water content in it. Therefore the present study agrees with other researchers suggest that the alginate powder can dissolve easily in aqueous and aqueous based solutions rather than any other liquid medium [16-17, 19].

3. Conclusion:
Isopropyl alcohol cannot be used as a medium for mixing alginate powder. Hydrogen peroxide and povidone – iodine are suitable for mixing alginate powder to obtain the self-disinfecting impression. Because of the brown colour of povidone- iodine, chromatic alginates didn't show colour change during setting. However other properties must be measured to understand the feasibility of these disinfectants as a liquid medium in alginate manipulation.

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