

EVALUATION OF TEARING STRENGTH AND ANTI-MICROBIAL PROPERTY OF SELF-DISINFECTANT ALGINATE VERSUS CONVENTIONAL ALGINATE

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ABSTRACT

Background: This study was collected to evaluate the tear strength and anti-microbial activity of self-disinfecting alginate that contain magnesium oxide on candidal growth. In this study fifteen completely edentulous male patients without history of denture-wearing were included . All selected patients were rehabilitated by complete dentures. For alginates, tear strengths vary from 0.4 to 0.7kN/m, The tear strength is important when an impression involves a mechanical undercut or lacks bulk strength to resist tearing. To avoid any changes could happen in Alginate impressions it must poured immediately or within 12 min in 100% humidity at room temperature, or could be poured until 45 min if stored in 100% humidity at 4°C. The impression dimensional stability meaning the impression is accurate to keep this accuracy of the impression should avoid any changes in impression, Dimensional instability is unfavorable condition. Therefore, the dimensional instability of the alginate impression should be with acceptable range up to 0.15%. **Aim:** The purpose of this study was to compare between two different alginate materials regarding antimicrobial property and tear strength. **Materials and Methods:** Swabs were collected from all the patients from maxillary arch before impressions making. The first impression made by (jaltrate-regular set-dentsply) and disinfected with sodium hypochlorite, the second impression was made by (jaltrate plus-ruglure set- dentsply) which contain magnesium oxide and the third one was made by (jaltrate – dentsply) without dis-infecting. All the impressions were poured with dental stone. Swabs were taken after 24 hours incubation period. A germ tube test was carried out to identify the candida albicans from another candida species under a light microscope. **Results:** The results of this study a revealed statistically significant difference, less candida albicans growth on casts made from self-dis infecting alginate (jaltrate plus- dentsply-) containing magnesium oxide compared with conventional alginate (jaltrate – dentsply). Also, observed an improvement of the tear strength in self dis-infecting alginate when compared with conventional alginate. **Conclusion:** Within the limitations of this study, it can be concluded that the addition of magnesium oxide to alginate proved to have an anti-fungal activity and improve alginate tear strength.

KEYWORDS: Tearing Strength, Anti-Microbial Property, Self-Disinfectant Alginate, Conventional Alginate

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INTRODUCTION

For fabrication dental prosthesis accurate impressions are important. Irreversible hydrocolloids or (alginate) is the most popular dental impression material used in dental clinics because they are inexpensive, simple to use, has pleasant taste and acceptable accuracy.

The alginate impressions materials was used for many purposes such as preparation of a diagnostic casts, fabrication of temporary prosthesis, custom tray, and a master cast for fabrication of complete dentures, partial dentures and for maxillofacial prosthesis. ^(1,2)

Irreversible hydrocolloid impressions undergo tearing during removing from patient mouth which may lead to distortion of alginate impression material. Distortion in impression will lead to an inaccurate cast. ⁽³⁾

Factors that would affect tear strength of alginate includes powder/ water ratio, mixing time of alginate, time of removing impression from patient's mouth and rate of impression removing from patient's mouth

Clinically, the initial set of alginate is determined by a loss of surface thickness so an alginate impression must be left in the patient's mouth for a 2 to 3 minutes to allow proper strength of alginate. Untimely removing of an alginate impression may cause unnecessary tearing of the alginate material. It is important to bear in mind the gel strength doubles through the first 4 minutes after initial setting.

The physical strength of alginate gel is such that a sudden force is more successfully resisted than a slow, sustained force. The material also displays improved elastic recovery when an impression is rapidly removed. ^(4,5,6)

Alginate impressions should be poured immediately with dental stone to minimize the dimensional changes which occurs over time. It is

not always possible to pour a cast immediately to minimize such distortions. ^(7,8,9)

American national standards institute and American dental association (ANSI/ADA) had developed standard practices for measuring properties of impression materials. Specification No. 18 was developed for alginates ⁽¹⁰⁾

On the other hand antimicrobial property of alginate material is very important to minimize risk of infection. Bacteria and microorganism can be found in saliva or blood, which can be transmitted to doctor or from patient to another patient ^(11,12).

Multiple companies started to introduce addition in the conventional alginate, which have the high antimicrobial property and have good dimensional accuracy, but these materials are still under clinical trials.

In this study, the tear strength and anti-microbial activity were compared between conventional alginate and self dis-infecting alginate.

MATERIALS AND METHODS

Criteria For Patients' Selection and Patients Examination:

Fifteen completely edentulous participants were selected from the outpatient clinic, Prosthodontic Department, Faculty of Dentistry, Ain-Shams University. All patients were given a detailed information about the research and signed a written informed consent.

In this clinical study, Fifteen swab samples were collected from patient's maxillary arch before impression making. Also 15 swab samples were collected after impression making and converted to stone cast in the first day, second day and the third day another 15 swab samples were collected after impression making and pouring casts. A total 60 swab samples were collected from the patient's mouth and palatal side of the casts.

1) Patients selection:

The included patient's ages ranged from 50 to 65 years old. All included patients were cooperative, non-smokers. All patients had good general health and free from any systemic diseases that might influence the mouth condition e.g.: diabetes, anemia and immune-deficiency conditions.

All included patients had well-formed residual ridges and free from severe undercuts. Also all patient with normal mucosal coverage free from any signs of inflammation, ulceration or hyperplasia.

Patients with severe salivation or thick ropy saliva, dry mouth were excluded. All Temporomandibular joint disorders patients excluded. All patients with Para-functional habits such as bruxism, clenching and had high gag reflex also were excluded.

2) Patient's examination:

A. Patients' history:

Medical history: participants were asked about their medical and dental history through a direct interview and a detailed questionnaire sheet. Participants were asked about the causes, previous extraction and previous experience with any prosthetic appliance. Any TMJ problem was also recorded.

B. Examination of the temporomandibular joint:

Examination of the TMJ was made by opening, closing and lateral movements to exclude any TMJ disorders or tenderness of the masticatory muscles.

C. Intra oral examination:

To fulfill the selected criteria. A clinical examination was performed for the residual ridges. To detect any inflammatory signs, pathology or flabby tissue the mucosa of the edentulous area was examined both visually and digitally. Examination was carried out to detect any bony undercuts, sharp ridges, tori or any abnormality.

- **Patients' randomization:**

It was a randomized study in which fifteen edentulous patients were in one group. Each alginate materials were used for each patient. Participants were selected depending on the previous inclusion and exclusion criteria.

Randomized swabs were taken and sealed in envelopes then divided into four groups:

GI: Swab from patient mouth, GII: Swab from (cast A) that made from conventional alginate, GIII: Swab from cast (B) that made from conventional alginate with disinfecting solution, GIV: Swab from cast (C) that made from self disinfecting alginate.

- **Clinical steps:**

Infection control procedure were performed for each patient. All patients were advised to avoid food consumption and drink water only, one hour before impression making, swabs were taken from each patient intra-orally before making impression.

The following procedures were made to each patient for a successive three days:

First day: (impression A)

Aluminum stock tray was modified for proper width, length and sufficient room for alginate material. The alginate (jeltrate-regular set – Dentsply) (Fig.1) was mixed followed the manufacturer's instructions at a controlled temperature and humidity environment to prevent any dimensional alteration. Mixing ratio was 8g:19ml water according to ADA Specification 18. Mixing time was 60 sec and setting time was 3'30" where they remained there for 2 minutes and 30 sec gelation time. Modified stock tray was loaded with alginate mix. The set tray/impression material was positioned into the patient mouth from posterior to anterior direction. Once impression material was set, alginate was removed with a quick snap, breaking

the seal between the oral tissues and the tray (Fig.2). The impression was rinsed after removal from the patients mouth with running water to get rid of any saliva, food debris, or blood. The impression was poured to produce study casts, by using BMS Gypsum (Joual dental Stone-Korea).After 10 min, the cast was removed from impression. All remnants of impression materials were removed without cast distortion After complete set of dental stone, the cast (cast A) was swabbed from fitting surface after 24 hours and swabs were sent to the lab in a sterile plastic package.



Fig. (1) Jaltreate alginate impression materials



Fig. (2) Maxillary impression

Second day: (impression B)

The same steps were repeated as in the first day but immediate disinfection was made following universal disinfection procedures before pouring cast B (immersion in 0.5% NaOCl for 10 min). The impression was poured to produce study casts, by use BMS Gypsum (Joual dental Stone-Korea) after impression removed from disinfectant solution. The impression was poured to produce study casts, by using BMS Gypsum (Joual dental Stone-Korea). After 10 min, the cast was removed from impression. All remnants of impression materials were removed without cast distortion. After complete set of dental stone, The cast (cast B) was swabbed from fitting surface after 24 hours and swabs were sent to the lab in a sterile plastic package.

Third day: (impression C)

The same steps were repeated as in the first day using self dis-infecting alginate. The impression was rinsed after removal from patients mouth with running water to get rid of any saliva, food debris, or blood. Then the impression was poured to produce study casts, by using BMS Gypsum (Joual dental Stone-Korea). After 10 min, the cast was removed from impression. All remnants of impression materials were removed without cast distortion. After complete set of dental stone, The cast (cast C) was swabbed from fitting surface after 24 hours and swabs were sent to the lab in a sterile plastic package.

Swabs:

Swabs were taken from patents' mouth before impressions making. Swabs were taken with a sterile cotton swab *citoswab transport swab (viscosechina)* (Fig. 3) and saved in saline media until send to the lab in a sterile plastic package. The casts were attained and the swab samples were obtained from the palatal side and crest of the ridge of the maxillary casts (A- B -C). (Fig. 4, 5)



Fig. (3) A sterile cotton swab

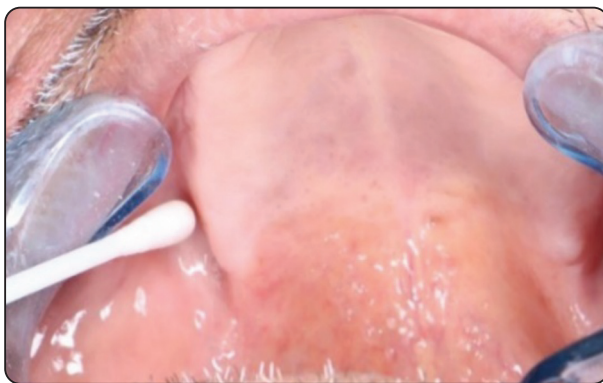


Fig. (4) Intra-oral swab (maxillary arch)

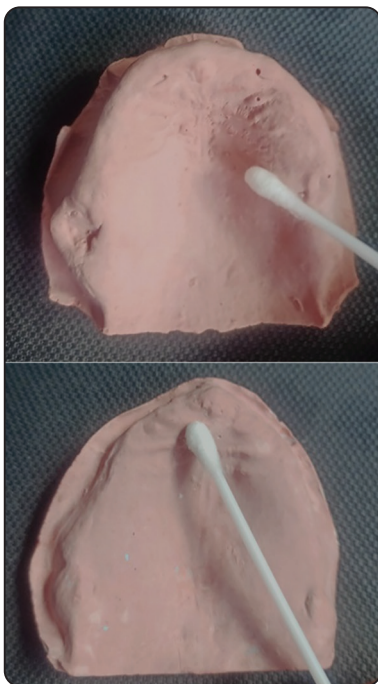


Fig. (5) Extra-oral swab (cast swab)

- *Preparation of culture media for Candida: (Fig. 6)*

3a) Sabouraud's dextrose agar Preparation:

The Sabouraud's dextrose media (Merck, Darmstadt, Germany) containing 0.01g chloramphenicol (Fluka, Steinheim, Switzerland) were prepared by suspending 6.5 g of the media in 100 mL distilled water and mixed well by a magnetic stirrer until a homogenous uniform suspension was obtained. The media then were heated with frequent agitation and boiled and then sterilized at 118-121°C for 15 minutes. Finally, the media were dispensed into sterile plates.

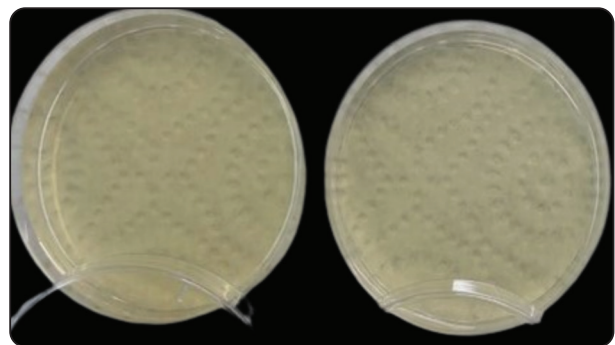


Fig. (6) Intra-oral swab (maxillary arch)

3b) Preparation of Blood agar culture media: (Fig. 7)

Blood agar medium was prepared by suspending a 2.8 g of nutrient agar powder in 100 mL of distilled water, the mixture was heated while stirring to fully

dissolve all components. The dissolved mixture was autoclaved at 121°C for 15 minutes. Once the nutrient agar has been autoclaved, it was allowed to cool to 45-50 °C, then 5% of sterile defibrinated blood that has been warmed to room temperature was mixed gently. Finally, the media were dispensed into sterile plates.

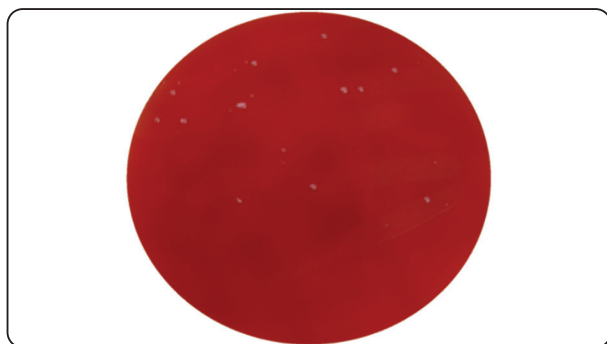


Fig. (7) Shows blood agar growth after 6 hours' incubation period

3c) Germ-tube test to candida albicans identification:

A single pure colony lightly with a sterile loop used to pick by touching candida cells. Wassermann tube was used to suspended the candida cells in 0.3-0.5mL human serum. The serum culture was incubated at 37°C for 2.5-3 hours. Using the Loop, single drop of the serum culture was placed on a clean slide, then covered with a glass cover followed by a microscopic examination. The mother cells appeared as cylindrical narrow filaments without constriction.

3d) Gram staining:

Gram staining was used to identify the growth of Candida, according to the provided protocol:

The procedure of Gram Stain:

The smear was covered with crystal violet and allowed to stand for one min, then under tap water it was rinsed. After that, the Gram's iodine was used to cover a smear and allowed to stand for 1 min, then under tap water was rinsed again gently. The smear was decolorized with 95% alcohol (Isopropyl Alcohol -maxill-China).

The magnifications of images are x40, the microscopic examination of stained sections was carried out by LABOMED Fluorescence microscope LX400, cat no: 9126000; US and LABOMED camera software, USA. The Candida appeared as gram-positive (purple color).

3e) Counting of colonies

The number of colonies (CFU) in all samples were counted using the spiral plate counting method At the end of incubation :

The spiral growth in each plate was divided into 8 equal sections, which were then divided into 4 concentric rings. The count was restricted to the 3rd and 4th counting grid ring sections only as the culture plate is 150 mm. The colony counting was performed within these $\frac{1}{8}$ sectors of the counting grid's rings. The count begins at the outermost grid ring inwards towards the center. Then the CFU was calculated using the following formula: $CFU/ml = (N' + N'') / (V/4)$, where: N' = CFU count in the first 1/8th ring sector = CFU, N'' = CFU count in the opposite 1/8th ring sector = CFU, V = Volume of the corresponding space.

TEAR STRENGTH

This study was carried out in the Biomaterial Department, Faculty of Dentistry, Ain-Shams University to measure two different alginate impression materials (jeltrate – regular set - Dentsply vs self-disinfecting alginate jeltrate plus- regular set- Dentsply) used *Lloyd instrument LR5K NEXYGEN-Plus Data Analysis Software*.

1. Apparatus and materials according to ISO 21563:2013(E)

Specimen sheet forming mould thickness (4,0±0,5) mm. Poly-ethylene sheets thickness, approximately 0,035 mm , oven, held at (35±2)°C, water bath. The dial indicator had graduations of 0,01 mm, a measuring range in excess of 10 mm, test instrument, a tensile force of at least 50 N at a rate of 500 mm/min to measure tear strength. (fig. 8&9)

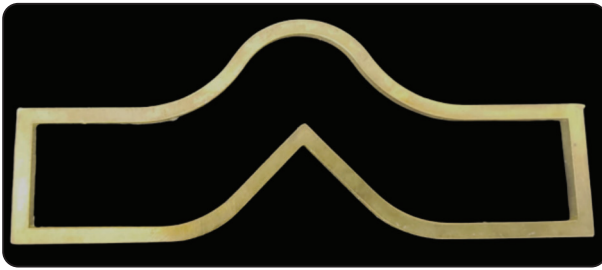


Fig. (8) Specimen sheet forming mould according to ISO 21563:2013(E)

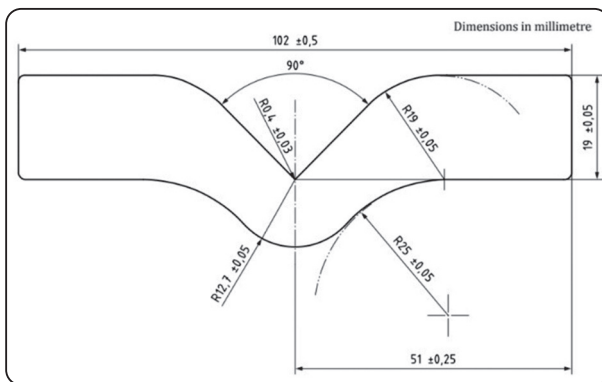


Fig. (9) Diagram showing specimen mould dimensions in millimeter

Perpetration of specimen:

Specimens were divided into two groups:

Group 1 (GA1) was (jeltrate alginate -regular set –dentsply) and group 2 (GA2) was (self-disinfecting alginate jeltrate plus- regular set- Dentsply).

The alginate was mixed following the manufacturer's instructions at a controlled temperature and humidity environment to prevent any dimensional alteration. Mixing ratio was 8g:19ml water according to ADA Specification 18.

Mixing time was 60 sec and setting time was 3"30" where they remained there for 2 minutes and 30 sec gelation time. Before perpetration of specimens the mold was placed in oven (35 ± 2)°C for 15 min., to simulate intra-oral temperature condition.

Specimen formation and post-formation steps:

The following steps were completed within 60 sec:

Test block was removed from the oven and the test block was seated on flat glass specimen cover plate, around (50 mm x 50 mm and 3 mm thick). One side covered with a polyethylene sheet. A very thin film of the high vacuum grease spread over the underside of the glass plate that would keep the polyethylene sheet smoothly adapted to the plate approximately (0,035 mm thick). The surface of the test block was lined with freshly made solution (1 % solution of tetra-decylamine in acetone), to prevent adherence of the alginate specimen material. 5 ml of the mixed material was loaded to the center of the test block, at 15 s prior to the stated working time. The polyethylene covered glass plate was pressed with the alginate with another flat glass plate above the test block, slowly and without any twisting motion, so as to expel most of the excess. To remove any excess of materials until test block boundaries appear, the sample was put in water path container for 3 minutes to simulated intra oral temperature of (35 ± 2)°C, after the simulated oral time-temperature treatment, the specimens were separated from the test block impression material/ mold assembly, then rinsed with water by using a gentle air stream to expelled a gross amounts of water from the lined surface, and did not dry the surface of specimens, specimens were handled very carefully during procedure to prevent stress on notched area of the specimens, before apply test load on samples.

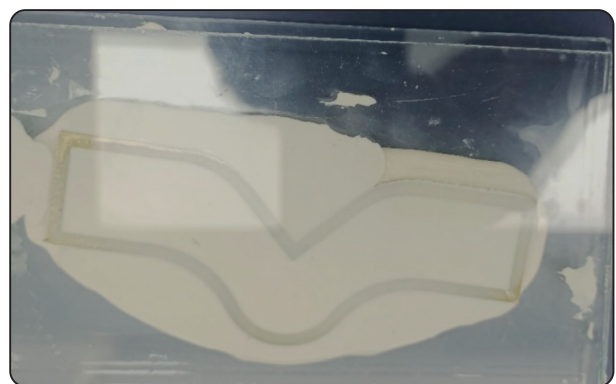


Fig. (10) Specimens placed in water path of (35 ± 2) °C for 3 min to simulate intra oral temperature

2. Test steps:

The specimens were secured in the gripping mechanism (*Lloyd instrument LR5K NEXYGENPlus Data Analysis Software*). then load was applied at a speed of 500 mm/min till specimen ruptured of the. The force needed to achieve rupture was recorded. (Fig. 11)



Fig. (11) Rupture of the specimen

3. Calculation of results:

Equation was used to calculate the tear strength for all samples to the nearest 0,01 N/mm:

$$T_s = F/D$$

Where:

T_s = tear strength (N/mm).

F = tensile strength, in Newton's, applied to rupture of the samples.

D = thickness of samples (mm).

Statistical analysis:

Kolmogorov-Smirnov test was used to explored for normality of the date. The results of Kolmogorov-Smirnov test was used to specify that the data

recorded values were distributed normal. Therefore, one-way analysis of variance (ANOVA) test was used to compare between groups, then followed by Tukey's post hoc test for pairwise comparison and Independent-samples t-test of significance was used when comparing between two means. The significance level was set at $p \leq 0.05$. Statistical analysis was performed with SPSS 18.0 (Statistical Package for Scientific Studies, SPSS, Inc., Chicago, IL, USA) for Windows.

To evaluate tear strength using two different alginate materials in tear strength (conventional alginate vs. self-disinfecting alginate) using model samples made through modal A (conventional alginate) and modal B (self-disinfecting alginate) then testing tear strength using universal testing device.

RESULTS

In this clinical study, Fifteen swab samples collected from patient's maxillary arch prior to impression making. Also 15 swab samples were collected after impression making and converted to stone cast in the first day, second day and the third day another 15 swab samples were collected after impression making and pouring casts. Totally, 60 swab samples were collected from the patients mouth and palatal side of the casts.

In this In-vitro research study evaluation of tear strength of five specimens was made from conventional alginate with proper p/w ratio. Also, another five specimens were papered from anti-microbial alginate contain magnesium oxide. So, 10 specimens were prepared according to ISO 21563:2013(E)

I. Normality test:

Kolmogorov-Smirnov test of normality. The results of Kolmogorov-Smirnov test indicated that data recorded values were normally distributed. Therefore, one-way analysis of variance (ANOVA) test was used to compare between groups, followed

by Tukey's post hoc test for pairwise comparison and Independent-samples t-test of significance was used when comparing between two means.

II. Evaluation of Candidal growth:

In group I (Swab from patient mouth) the highest mean value was recorded (98430.0±9843.0), followed by group II (Swab from conventional

alginate) (77665.3±7766.5), then group III (Swab from conventional alginate with dis-infecting solution) (44250.0±4425.0), in group IV (Swab from self dis-infecting alginate) the least value recorded (35003.0±3500.0). A statistically significant difference between groups (P=0.000) revealed by ANOVA test. No significant difference between groups III and IV revealed by Tukey's post hoc test. (Table 1)

TABLE (1) Showing, results of ANOVA and post hoc tests for the comparing different groups regarding candida albicans count with mean ± SD values.

Groups	Mean	±SD	±SE	95% C.I.		Min.	Max.	F-test	p-value
				Lower	Upper				
Group I	98430.0a	9843.0	5682.9	73978.6	122881.4	88587	108273		
Group II	77665.3b	7766.5	4484.0	58372.3	96958.4	69899	85432	55.079	0.000*
Group III	44250.0c	4425.0	2554.8	33257.7	55242.3	39825	48675		
Group IV	35003.0c	3500.0	2020.7	26308.5	43697.5	31503	38503		

Significance level $p \leq 0.05$, *significant

Tukey's post hoc: Means sharing the same superscript letter are not significantly different

GI: Swab from patient mouth

GII: Swab from (cast A) that made from conventional alginate.

GIII: Swab from cast (B) that made from conventional alginate with dis-infecting solution.

GIV: Swab from cast (C) that made from self dis-infecting.

III. Tear Strength

In this In-vitro experimental study evaluation of tear strength of five specimens was made from conventional alginate with proper p/w ratio. Also, another five specimens were prepared from anti-microbial alginate contain magnesium oxide. So, 10 specimens were prepared according to ISO 21563:2013(E)

1- Calculate the tear strength

Evaluation of tear strength was made by equation ($T_s = F/D$) which present tear strength after applied load by N on specimens using *Lloyd instrument LR5K NEXYGENPlus Data Analysis Software*.

$$(T_s = F/D)$$

Where:

T_s = tear strength (N/mm).

F = tensile strength, in Newton's, applied to ruptured of the samples.

D = samples thickness (mm).

2- Independent Sample t-test:

The highest mean value was recorded in antimicrobial alginate group (0.194±0.045), followed by conventional alginate group (0.141±0.023). Independent Sample t-test revealed that there was a statistically significant difference between groups with p-value (P=0.047), (Table 2).

TABLE (2) Showing the mean \pm SD values, results of t-test for the comparison between different groups regarding tear strength.

Groups	Mean	\pm SD	\pm SE	95% C.I.		Min.	Max.	t-test	p-value
				Lower	Upper				
Conventional Alginate	0.141	0.023	0.015	0.109	0.190	0.119	0.202	2.245	0.047*
Antimicrobial Alginate	0.194	0.045	0.029	0.120	0.267	0.125	0.278		

Using: Independent Sample t-test

Significance level $p \leq 0.05$, *significant

DISCUSSION

Alginate impression material is the most used impression material. It is easy to use, inexpensive and accepted by the patients. During impression making alginate material is prone to contaminated from saliva and micro-flora of the patient's mouth. Microbes such as *Candida albicans* were able to adhere and attach to the impression surface which is considered a source of cross infection. ADA recommend using at least a medium-level disinfectant when making an impression. ^(13,14)

Aging, metabolic disease or salivary gland hypo function in edentulous patients are factors that make *Candida albicans* liable to pathological colonization. *Candida albicans* is one of the multifactorial causes related to denture stomatitis, as previously reported that 54 – 74% of denture-related stomatitis cases were caused by *Candida albicans*. ^(14,15,16)

Many anti-microbial agents have been added to alginate powder composition to improve alginate antimicrobial activity without using spray or immersion disinfection methods which affect dimensional stability of alginate impression. There are different studies that discussed nanotechnology and the effect of nanoparticles to enhance the antimicrobial properties of alginate on *Candida albicans* and mechanical properties such as silver nanoparticles, nitra oxide nanoparticles and zirconium oxide nanoparticles, but the information about the antifungal effects of these nanoparticles is limited. ^(17,18)

In this study the effect of using magnesium oxide nanoparticle with alginate (jaltre plus dentsply alginate) for improving anti- fungal property and tear strength were evaluated.

Female participants weren't included in the study to prevent the possible menopausal and post-menopausal effect in the oral cavity, also to exclude the high oral yeast count which had been reported in the females. All subjects selected ranged from 50-65 years to avoid the effect of aging on the oral microbial flora. ^(19,20)

Systemic diseases like immune-deficiency, diabetes and anemia had been noted to change oral microflora, resulting in increased inflammation of mucosa in edentulous patients. So, patients free from systemic diseases were selected in this study. ^(19,21)

Oral cavity PH changes and inflammatory exudates secretion were reported to induce mucosal inflammation and play a role in the growth of *Candida albicans*. For this reason, all selected patients were with healthy oral mucosa. ^(22,23) Furthermore the count of the *Candida albicans* may be affected by plaque accumulation on old dentures, that was the reason old denture wearers were excluded. ^(24,25)

All included participants were non-smokers, smoking decrease salivary flow which effect the buffering activity of saliva that influence *Candida albicans* growth on oral mucosa. ⁽²⁶⁾ The quality, quantity and viscosity of the saliva flow are factor in patient selection, participants with xerostomia

were excluded as they may suffer from mechanical trauma during impression making. Patients with excessive salivation or thick ropy saliva were not considered. ⁽²⁷⁾

Using perforated aluminum stock tray in patient mouth with proper width, length to provide sufficient room for alginate material and to allow for the optimum 4 to 6 mm cross-sectional thickness of the alginate ⁽²⁸⁾ The alginate (jeltrate –regular set – Dentsply) and (jaltrate plus- regular set-dentsply) were mixed following the manufacturer's instructions at a temperature and humidity controlled environment to control the factors that lead to dimensional alteration. Mix ratio 8g:19 ml water according to ADA Specification 18, mixing time 60 sec and setting time 3"30" where they remained there for the gelation time 2 minutes and 30 secs ⁽²⁹⁾

Mixing of alginate was carried out by the same operator to avoid any variations when making the impression. ⁽²⁹⁾ The swabs from each patient were taken at constant time every day for 3 days to prevent any changes in oral flora of each patient, the oral flora variation affected by age, diet, personal hygiene, smoking, systemic disease also the time of the day. ⁽²⁶⁾ A swab of the mucosa site was taken as it is simple to perform and widely used to detect candida count before impression and after the cast was poured by 24 hr. ^(30,31)

Tearing of an alginate material can cause inaccuracy and deformation of the stone cast that produces the primary base for a prosthetic appliance. In the present study tear strength of jaltrate- regular set dentsply alginate without magnesium oxide particles and tear strength of jaltrate plus- regular set-dentsply alginate contain magnesium oxide particles were evaluated. ⁽³²⁾

Multiple factors can affect the tear strength of alginate, one of them is powder/water ratio. Any changes of correct p/w ratios and mixing technique could make difference in the tear strength. Therefore, in this study powder/water mix ratio was 8g:19 ml water for both type of alginate according to ADA Specification 18. ⁽¹³⁾

In this *in-vitro* experimental study, mold was made with 102mm×19 mm with 4mm thickness of a specimens. Evaluation of the tear strength in this research was done using V-shaped specimens 4 mm thickness to be close enough to the recommended thickness of the alginate material (4 to 6 mm range). ⁽⁵⁹⁾

Before perpetration of specimens the mold was placed in Oven, held at (35 ± 2) °C, for 15 min to simulate intra-oral temperature condition of the test block. All samples were prepared according to manufacturer instructions and loaded into the mold and the mold was pressed. After removing the mold from pressing, samples were put in water path to simulate intra oral environment. The sample was pulled in grapping machine with 500 mm/min speed. ⁽³³⁾

Different studies demonstrated the role of MgO and deletion of MgO with alginate powder resulted in a material with a low tear strength, in particular, the role of MgO as a cross-linking agent was accomplished. ⁽³⁴⁾

Number of candida colonies forming units per ml (CFU/ml) between different groups showed significant difference in swab samples.

According to this study findings, there is a rise in the frequency of Candidal density and colonization in the GI (swab from the patient's mouth) compared to other groups. This is because impressions were immediately rinsed under running water after being taken so 40% less bacteria, viruses, and Candida albicans will be present. ^(51,34)

A Significant difference was showed between GII (Swab from conventional alginate that rinsed immediately only by running water) and GIII (Swab from conventional alginate with dis-infecting solution) and GIV (Swab from self dis-infecting alginate). These findings can be interpreted as evidence that a microorganism can survive on, or even within, the impression material. Rinsing impressions with running water immediately was not a suitable method of disinfecting the impression materials. ^(36:38)

Several studies reported the colonization of bacteria and candida on dental casts stone after contamination with artificial saliva and candida did not reduce after 4 hours from initial setting of cast stone. also microbiological analysis of dental cast showed that *Candida albicans* had survival up to 4 days.^(39,40)

No significant difference was observed between GIII (Swab from conventional alginate with disinfecting solution) and GIV (Swab from self disinfecting) these results can be attributed to 0.5% NaOCl for 10 min that NaOCL destroying candida by rupture of cell wall, inhibit the enzyme activity necessary for the growth, and damage DNA of micro-organism cell.⁽⁴¹⁾

According to earlier in-vitro research, adding magnesium oxide (MgO) to alginate increased the antifungal activity of the alginate impression materials. This may be due to the free radicals that cause candida albicans cells to undergo apoptosis. Additionally, the reduction in the candida count could have been aided by the generation of reactive oxygen species. Jaltrate-plus-dentsply alginate which contains MgO, has anti-fungal properties as a result^(32,42). These properties may disrupt cell permeability, cause oxidative stress and impede cell growth.⁽⁴³⁾

According to the findings of this in-vitro investigation, there was a statistically significant variation in tear strength between the groups. The presence of MgO in group2 results in a material with higher tear strength and hardness as well as shorter setting time, suggesting its critical role. The absence of MgO in group1 led to lower tear strength and hardness as well as longer setting time.^(34,44)

This is in agreement with Fayez et al. 2016 and Zarb et al. who stated that any modifications of the given powder–liquid ratio, mixing technique, and filler content as addition MgO could result in alterations in the properties of the gel, tear energy, and elastic recovery.^(45,46) therefore MgO have important role as cross-linked agent in alginate powder in GII, which improve tear resistance.

CONCLUSION

Based on the obtained results and within the limitations of this study, it could be concluded that the addition of magnesium oxide to alginate have anti-fungal activity and improve alginate tear strength.

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