

An in Vitro Study to Evaluate the Accuracy of Addition Silicone and Polyether Impression Materials after Different Pouring Time.

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الخلاصة

الاهداف: لتقييم دقة نوعيتين مختلفتين من مواد الطبوعات ولتقييم تأثير وقت صب الطبوعات على دقة الطبعة. **المواد وطرائق العمل:** اربع زرعات مستقيمة تم غرسها في القالب الرغوي للحصول على الموديل الدراسي، وباستخدام طبعة السيليكون من النوع الاضافي ذات الهيئة المتوسطة وطبعة البولي ايثر ذات الهيئة المتوسطة تم اخذ عشرين طبعة للموديل الدراسي بطريقة احادية المرحلة، اخذت عشرة طبعات منها بمادة السيليكون من النوع الاضافي وعشرة اخرى بمادة البولي ايثر تحت تقنية الحامل المغلق، تم صب نصف الطبوعات بعد مرور ساعة وتم صب النصف الاخر بعد مرور يوم كامل بمادة الحجر السني للحصول على قوالب الحجر السني، باستخدام المجهر المتجول تم قياس ثلاث قياسات خطية بين الزرعات الاربعية، وباجراء المقارنة بين القياسات على الموديل الدراسي والقياسات على قوالب الحجر السني لتحديد التغيرات البعدية لمواد الطبوعات. **النتائج:** التحاليل الاحصائية للنتائج باستخدام الاختبار التائي لعينة واحدة ذات قراءتين اظهرت عدم وجود اختلاف معنوي في دقة كلا من المادتين المستخدمتين للطبوعات بعد مرور ساعة وبعد مرور ٢٤ ساعة عند مستوى احتمالية (٠.٠٥) كما اظهرت النتائج المحللة باستخدام الاختبار التائي لعينتين عدم وجود فرق معنوي بين المادتين تحت طريقة الحامل المغلق (التغيرات البعدية لا تزيد عن ١٪). **الاستنتاجات:** اظهرت النتائج عدم وجود اختلاف في دقة المادتين المستخدمتين لاخذ الطبوعات وعدم وجود تأثير لوقت صب الطبعة على دقة الطبعة، كما اثبتت النتائج الاستقرار البعدي للمادتين المستخدمتين.

ABSTRACT

Aims: To evaluate the accuracy of two different impression materials and to evaluate the effect of time of pouring on the accuracy of impression. **Materials and Methods:** Four parallel implant placed in foam arch to obtain study model. Medium body addition silicone and medium body polyether are used. 20 impressions of study model were taken under monophase technique, 10 by addition silicone and 10 by polyether by closed tray technique, half of them were pour after one hour and another half of the impressions were poured after 24 hours by die stone to obtain casts. By using Traveling microscope three linear measurements were measured between 4 implants and comparsime was made between distances on the model and on the casts to assess the dimensional changes of impression materials. **Results:** Statistical analysis of data by paired sample T-test at ($p \leq 0.05$) reveals no significant difference in the accuracy of each material after one and 24 hours and the results analyzed by independent samples T-test reveals no significant difference between materials after one and 24 hours under closed tray technique (dimensional change don't exceed 1%). **Conclusions:** The results appeared that there is no difference in the accuracy between addition silicone and polyether and there is no effect of time (1h-24h) on the accuracy of impression, also results showed the high dimensional stability of two materials.

Keywords: Elastomeric impression material, Accuracy of impression, Techniques for implant, time of pouring.

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INTRODUCTION:

The major objective in making implant supported prosthesis is the production of superstructure that exhibits a passive fit when connected to multiple abutments⁽¹⁾ Impression making is a critical clinical step to record accurately the three-dimensional intraoral relationships among implants, teeth, and adjacent structures⁽²⁾

Inaccuracies during impressions inevitably lead to laboratory errors resulting in lack of precision and misfit of prostheses, particularly in fixed and implant-supported prosthodontics⁽³⁾ Many factors affect the accuracy of impression materials, these factors include; impression material selection, impression material manipulation⁽⁴⁾ impression material thickness,⁽⁵⁾ impression technique and impression removal,⁽⁶⁾ storage condition after removal, and material used for making the dies and its compatibility with the impression material⁽⁷⁾

Two basic impression techniques are commonly used for transferring implant positions from the intraoral cavity to a working cast: the direct (open tray) and the

indirect (closed tray) technique. In the direct technique, the transfer copings remain

in the impression and must be unscrewed before the impression is removed from the mouth. In the indirect technique, the transfer copings are retained on the implants after removal of the impression and must be re-positioned in the proper imprints⁽⁸⁾

The aim of this study was to:

1. Evaluate the accuracy of impression materials (addition silicone and polyether).
2. Evaluate the effects of time of pouring on the accuracy of impression.

MATERIALS AND METHODS:

Study Model Preparation:

The study model used in the research was prepared by using foam arch produced from Dentium Company of dental implant, the arch represent the lower jaw have more than one edentulous area.

Then by using surveyor milling machine, four parallel implants placed in the two edentulous areas, step by step of drilling and placement of four parallel implant in by using ratchet key screw the implant fixtures and the arch became study model for research. The plan of study show in Figure (1).

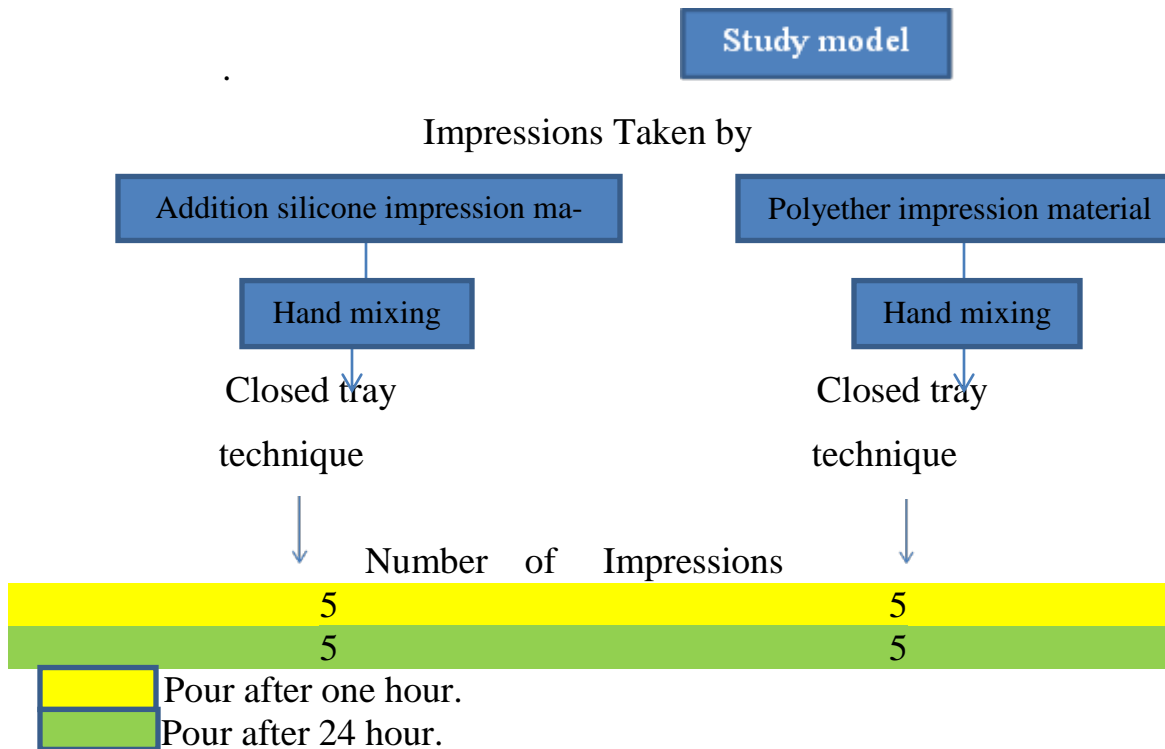


Figure (1) :Plan of study

Impression Materials of study:

In the study two types of impression material are used, it is medium body addition silicone (poly vinylsiloxane) and medium body polyether. The technique used for the impressions is single phase or mono-phase technique. The impressions classified into two groups, first group 10 impressions taken by medium body addition silicone and another 10 impressions taken by medium body polyether.

Test apparatus device:

For standardization of impression and standardization of loading applied on impression, test apparatus device was used, this device secure the position of study model and the direction of insertion and removal of square metal plate (loading arm⁹). The test apparatus device consist from square metal plate weighting 1.5 Kg was

placed on the impression tray to standardize the seating loading for etch impression. Also the device have base with 4 retained screw act as stoppers for standardization.

Impression Techniques:

The study model was screwed at the base of test apparatus device. The technique for impressions of dental implants was used in the study closed tray technique (indirect technique).

The material was mixed manually by hand according to the instruction of manufactures, then take impression to the study model under loading of test apparatus device about 10 minutes to polymerize⁽¹⁰⁾ after polymerization the impression is removed from the device and ready for pouring after delaying time.

Pouring the impression:

After complete polymerization the impression, the transfer copings with analogue attached in the impression according to the exact position and the impressions are pouring by using die stone, 10 of the impressions pour after one hour and another 10 impressions pour after 24 hour, the ratio of water powder according to instruction is 25ml water to 100ml powder mixed manually by spatula and rubber bowl for one minute.

Evaluation of accuracy:

The idea of study is to make comparison between study model and casts produced from impressions to evaluate the accuracy and stability of impression materials, three linear measurements (A, B, C) was determined and measured for the study model and casts as shown in Figure (2).

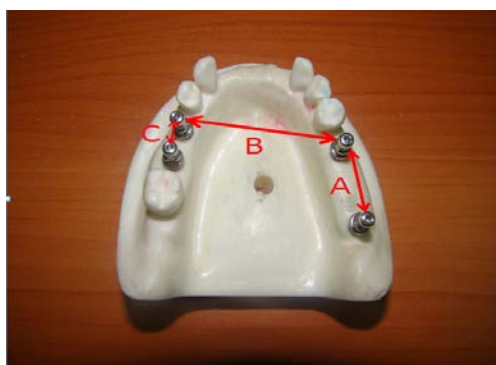


Figure (2) Show the model and 3 lines of measurements fixed on it (A, B, C).

The measurements are made from the center of head of transfer coping to another transfer coping by using travelling microscope device.

Travelling Microscope Device:

The measurements are made by using Travelling microscope (Griffin and George company, UK), as shown in Figure (3).



Figure (3). Travelling Microscope used in the study (Griffin and George company, UK).

A Travelling microscope is a mobile instrument that can measure the length of objects more accurately than the naked eye with a resolution typically in the order of 0.01mm. It is also used to measure very short distances precisely, for example the diameter of a capillary tube.

Linear measurement distance:

The measuring begin by fixed the study model and stone casts on metal stand in front of travelling microscope about 8 centimeters as shown in Figure (4).

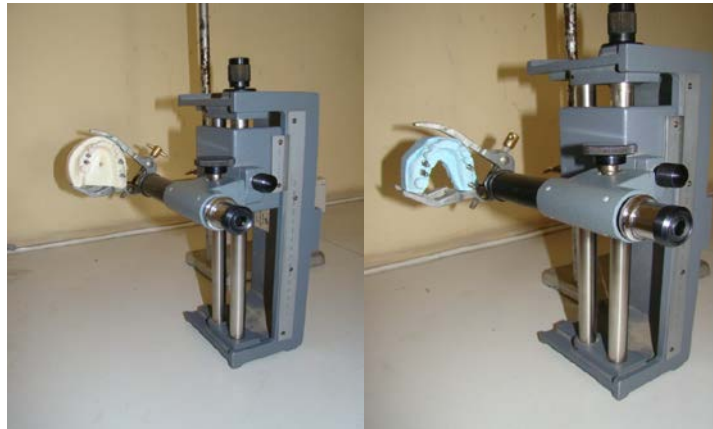


Figure (4) A. Measuring distances of study model, B. Measuring distances of stone cast.

Firstly placed the microscope in front of first transfer coping, then by sliding the microscope along the internal guiderail to make a rough adjustment to the head of transfer coping. Look through the eyepiece as move it until fine clearly appearance is obtain then stop adjusting. Then read the vernier scale to record the first reading and then move the microscope to the second transfer coping and record the second read-

ing, subtract the second record from first record result the distance between two transfer copings. Repeat this procedure with other linear measurements for all stone casts and record the results to make comparsime between study model and stone casts.

RESULTS

The results in Table (1)

Table (1). Paired sample t-test for addition silicone impression material after one and 24 hours.

Material	Technique	Pairs	t-value	df	p-value
Hand Mixing Addition Sili-cone	Closed Tray	A1 - A24	.535	4	.621
		B1 - B24	-2.058	4	.109
		C1 - C24	-.647	4	.553

df: Degree of freedom.

P: means are not significant at $P \geq 0.05$.

For paired sample t-test of linear distances (A, B, C) for closed tray technique for hand mixing addition silicone impression material after one and 24 hours revealed that there is no significant difference between distances. The results in Table (2) for paired sample t-test of linear distances

(A, B, C) for closed tray technique for hand mixing Polyether impression material after one and 24 hours revealed that there is significant difference between the distances (A1) and (A24), whereas no significant difference between the remaining distances.

Table (2). Paired sample t-test of linear distances (A, B, C) for closed tray technique for hand mixing Polyether impression material after one and 24 hours.

Material	Technique	Pairs	t-value	df	p-value
Hand Mixing Polyether	Closed Tray	A1 - A24	2.994	4	.040
		B1 - B24	.302	4	.778
		C1 - C24	.167	4	.876

df: Degree of freedom.

P: means are not significant at $P \geq 0.05$.

The results in Table(3) for independent samples t-test of linear distances (A, B, C) for closed tray technique for hand mixing addition silicone and hand mixing polyether

after one and 24 hours revealed that there is no significant difference between addition silicone and polyether after one and 24 hour for distances (A, B, C).

Table (3). Independent samples t-test for closed tray technique for hand mixing addition silicone and hand mixing polyether after one and 24 hours.

Material	Time	t-value	df	p-value
Hand mixing addition silicone and Hand mixing Polyether	A1	-.702	8	.503
	B1	-2.265	8	.053
	C1	.191	8	.854
	A24	1.414	8	.195
	B24	-1.500	8	.172
	C24	.945	8	.1000

df: Degree of freedom.

P: means are not significant at $P \geq 0.05$.

DISCUSSION

A variety of impression materials exist in order to capture the surface detail and dimensions of hard and soft tissues. The accuracy of an impression material is significant because it is essential for the fabrication of a well fitting removable and fixed prosthesis.⁽¹¹⁾

The ideal impression material should possess the high dimensional stability, which is critical for accurate replication of the intraoral structures. Dimensional changes may occur due to contraction from polymerization, liberation of a by-product or accelerator component, water absorption from a wet or humid environment, or a change in temperature. Materials with good dimensional stability can remain unchanged for a period of approximately 7 days and resist temperature extremes during shipping.⁽¹²⁾

Addition silicones produce highly accurate impressions because they reproduce fine surface detail, and have excellent elastic recovery and dimensional stability.⁽¹³⁾ On the other hand, Polyethers are known for their intrinsic hydrophilicity and thixotropic behavior.⁽¹⁴⁾

Polyvinylsiloxane and polyether have been used for many years as impression materials and have gained popularity because of their excellent accuracy and dimensional stability.⁽¹⁵⁾

Pereira et al.,⁽¹⁶⁾ found that the dimensional stability of addition silicone did not significantly change, not even after 96 hours since the impression was made (linear dimensional changes did not exceed 1%). These results agree with the previous studies of other researchers.

Corso et al.,⁽¹⁷⁾ measured the dimensional stability of PVS impression materials at time intervals of 10 min to 26 h and at storage temperatures ranging from 4°C to

40°C. They reported that the overall dimensional changes observed were extremely small. Similarly Pant et al.⁽¹⁸⁾ measured the long-term dimensional stability of four PVS duplicating materials and reported that measurements at 37°C showed less dimensional stability than those at room temperature, but the difference was not of clinical significance.

Eduardo et al.,⁽¹⁹⁾ Polyether and polyvinyl siloxane impressions may be stored for up to 14 days prior to pouring of the dies without compromising the accuracy of the material. However, in the other study, polyether and polyvinyl siloxane impressions could be stored without detrimental effects for up to 24 hours and 7 days, respectively. It should be noted that significant dimensional discrepancies were observed when the polyether impressions were stored for 7 days. The heavy-bodied material is likely to produce less discrepancy in comparison to the light-bodied material because it contains higher concentration of fillers.⁽²⁰⁾ The results of our study agree with the findings of other studies they found that addition silicone and polyether materials have high dimensional stability.^(21, 22, 23, 1)

CONCLUSIONS

Under limitation of this study we concluded that the addition silicone and polyether are the ideal materials for dental implant prosthesis because they reveals high dimensional stability with closed tray technique after pouring time, at (1h-24h) and there is no difference in the accuracy between these two materials.

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