ISSN: 1812–1217

Evaluation The Accuracy Of Modified Closed Tray Impression Technique For Multiple Angled Implants Using Condensation-Silicone Impression Material

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الخلاصة

الأهداف: هو تقييم دقة المسافة الخطية من طريقه جديدة معدله لطريقه اخذ الطبعة بالحامل المغلق ل(٦) زرعات مائلة بدرجه ٢٥ درجه وبالمقارنة مع تقنيه الحامل المفتوح باستخدام مادة الطبعة السيلكون من النوع المكثف. **المواد وطرائق العمل**: أعد معيار نموذج رئيسي مع ذظائر الزرعات (عدد ستة) مائلة شفويا وخديا بدرجه ٢٥ درجه.استخدمت طريقتين لأخذ الطبعة (بطريقة استخدام الحامل المفتوح وطريقة جديدة المعدلة و المربوطة لطريقة استخدام الحامل المغلق) و باستخدام مادة الطبعة السيلكون من النوع المكثف، ثم صب الطبعات للموديل الرئيسي بالحجر السني النوع الرابع .اخذت صور للنموذج الرئيسي ونماذج الحجرالسني الناتجه من اخذ طبعات للموديل الرئيسي بالطريقتين. لاجراء القياسات اولا تم تحديد النقاط داله وكذلك الخط الدال للنموذج الرئيسي ثم اجريت قياسات المسافة الخطية والزوايا الناتجة منها بواسطه برنامج ماتلاب ذات الاصدار (R2011a,7.12.0.635)، بعدها أجريت كامل القياسات لنماذج الاحجار السنيه عن طريق تنسيق نظائر الزرعات وبالتسلسل . عدد الطبعات كان عشر طبعات للطريقتين، خمس لكل منها . إحصائيا اجري الختبر التائي لعينة واحدة و الختبار التائي لعينيتين لتحديد الاختلافات المعنوية عند مستوى احتمالية ($p \leq$ ٠,٠٥). **النتائج**: اظهرت انه ليس هناك فرق معنوي بين المسافات والزوايا خطية من النموذج القياسي و نماذج الاحجار السنيه للطريقتين (بطريقة استخدام الحامل المفتوح وطريقة جديدة المعدلة و المربوطة لطريقة استخدام الحامل المغلق). **الاستنتاجات**: ان دقة الطريقة الجديدة المعدلة و المربوطة توازي دقة طريقة استخدام الحامل المفتوح لاخذ الطبعة (٦) زرعات مائلة لذلك يمكن اعتبارها طريقة دقيقة و سهلة الاجراء لاخذالطبعة) لزرعات مائلة غير متوازية.

ABSTRACT

Aims: is to evaluate the linear distance accuracy of new modified closed tray impression technique of 6 angled implants and compared with open tray technique using condensation silicone impression material. **Materials and Methods:** : standard master model was prepared with six angled implants analogues (25 degree) buccaly and labial deviated .Two impression techniques were performed (open tray and new modified splinted closed tray) using condensation silicone impression material , then poured with die type IV stone. Capturing of the standard model and stone casts produced from both impression techniques. To perfume the measurement, first determine and label the reference points and reference line on standard model then measure the linear distances and angles with Matalab software program (7.12.0.635(R2011a). The entire measurements of the stone models were done by coordination way of implants analogues in sequence .Total number of impressions was ten, five impression for each technique. Statistically one sample t-test and two sample t-tests were performed to determine the significance differenc at $p \leq 0.05$. **Results:** appeared there is no significance difference of the linear distances and angles of standard model and stone casts for open tray and a new modified closed splinted techniques. **Conclusion:** A new modified closed splinted technique is an accurate impression technique for multiple angled (6) implants as same as the open tray technique with condensation silicon, so a new technique is an accurate and easier technique to be carried out with multiple angled non- parallel implants.

Keywords: impression modified, angled implant.

Hammoodi OA, Rejab LT, Alwattar WT. Evaluation The Accuracy Of Modified Closed Tray Impression Technique For Multiple Angled Implants Using Condensation-Silicone Impression Material. *Al–Rafidain Dent J*. 2013; 13(3): 413-422.
Received: 3/6/2012 ***Sent to Referees:*** 5/6/2012 ***Accepted for Publication:*** 4 /7/2012

INTRODUCTION

Reproducing the intraoral relationship of implants through impression procedures is the first step in achieving an accurate, passively fitting prosthesis. The critical aspect is to record the 3-dimensional orientation of the implant as it occurs intraorally, rather than reproducing fine

surface detail. [1-3] The more common impressions techniques include the indirect, direct, and direct-splinted. Most research indicates that the indirect impression technique produces a greater mean distortion than the direct-splinted and the direct techniques.[4] The use of 2 or 3 implants reported no angulation effect on the accuracy of impressions. When multiple implants are placed with different angles, the distortion of the impression material on removal may increase. Also, this effect may be heightened by an increasing number of implants.[5] The open tray technique may present some disadvantages, like the possible imprecise positioning of the copings caused by, for example, vertical or rotational discrepancies.[6] Number of studies has reported increased accurate implant impressions with the splint technique than with the non-splint technique.[5,7]

The aim of this study is to evaluate the linear distance accuracy of new modified closed tray impression technique of 6 angled implants and compared with open tray technique using condensation silicone impression material.

MATERIALS AND METHODS

1. Preparation of master model:

One master model representing typical upper natural adult dentition (Frasaco ANA-4,Germany). All teeth removed from model and all the holes were sealed by visible light curing acrylic resin (Mega tray, Germany), then the model was flattened by (Lathe Machine ,China) to produce horizontal plane parallel to model base Master model is fixed to the rotary table of the milling and drilling machine (Weida, Germany).The drill of the machine is inclined 25 degree buccally and labially to the horizontal plane of the rotary table Figure (1).

Figure (1): Drilling and milling machine

Leader implant system (Italy) is used as analogues and copings transfer. Six analogues (4.5 mm in diameter) were inserted in the holes that positioned approximately at two central incisors, two canines and two first molars positions, then fixed in holes by visible light- cured acrylic resin. Then central reference point was located at the midpoint of inter-first molars distance of the model and extended from the bottom of the model to top level of the analogues, Figures (2).

Figure (2): Master model analogues

2. Impression techniques:

Condensation silicone impression material (zetaplus, zhermack/ Italy) was used with the two impression techniques

(open tray direct technique and a new modified closed tray technique). Condensation silicone products demonstrated the best recovery from undercuts.[8] Two perforated metal stock tray of the same type and size (U1) were used to take an impression. Modification tray was used with open tray technique; seven holes were made for escape long passing screw. Each tray was coated with the dedicated adhesive for the silicon impression (Universal Tray Adhesive, Zhermack).[6] For standardization, the impression of master model was made with a mechanical apparatus that secures a consistent master model position within the impression tray, providing the desirable thickness of impression materials, and identical direction of insertion and removal of upper metal plate with the tray that contains the impression material,[9] Figure (3).

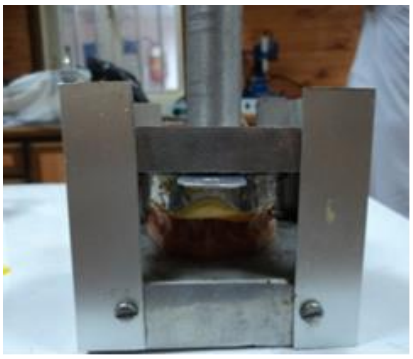


Figure (3): Mechanical apparatus for standardization impression record

A . Open tray (direct) technique : The master model is fixed in position in test apparatus, screw the coping transfer in its place by long passing screw in all six analogues Figure (4)

Figure (4): Master model with transfer copping

Heavy body and light body of the condensation-silicone impression material were mixed according to manufacture instruction, then loading the impression material in tray and record the impression in one step (pick up technique).[10-12] Apply fixed loading over tray to obtain standard loading for all models. [9] After hardening of impression, remove the model from test apparatus and loosening long passing screw for all coping transfer, waiting for 1 hour to relax rubber base impression material from stress.[13] The impressions poured type IV dental die stone (Elite, Italy).[14]

To create plane parallel to horizontal base of surveyor, rubber mold was used for pouring cast base that standard for all impressions for establish even base for all impression. And to establish standard orientation of stone cast with impression tray so we use surveyor with analyzing rods that touched the metallic stock tray at three areas at pouring the paralleled base.

B . Modified closed tray technique:

With closed tray technique an inaccuracies with recovery and subsequent deformation may be encountered with non-parallel implants. Impression copings must also be repositioned exactly into their respective positions in the impression, otherwise, misfits will occur.[1,15] So in this

study a new modified closed technique was performed as follow:

Coping transfers were secured with analogues on the standard model. Each two coping transfers were splinted by visible light cure acrylic resin, and block undercut areas around the analogues. Three separated splint were prepared, Figure (5).

Figure (5): Splinting transfer coping

Then take impression with mechanical apparatus as in direct tray technique. Then remove the load and separate the impression from model, after that unscrew the splinting coping and removed from model then returns to negative position in impression Figure (6). Put analogues in its position attached with coping then pouring with die stone as in direct technique, Figure (7).

Figure (6): Impression with Modified impression technique

Figure (7): Stone model

3. Construction of standard position for capturing model and casts:

Rubber mold fixed into piece of cork. Beside this mold ruler was fixed to a level with same level of casts in mold . Stand of digital camera fixed on cork that centered over rubber mold with distance 10 cm from lens of camera to roof of cast then stabilize the digital camera (Sony,12 mega pixel, China) by hand screwing in camera stand present.

4. Linear distance measurements:

Capture pictures of master model and stone casts .The measurements of the linear distance of the models were carried out with Matalab software program (7.12.0.635(R2011a) as follow:

First step locate and label six external reference points on the external edges of the six analogues of the master model labially and bucally. Second; draw a line passing through central reference point horizontally as a reference line, then the measurement was performed (Figure 8).

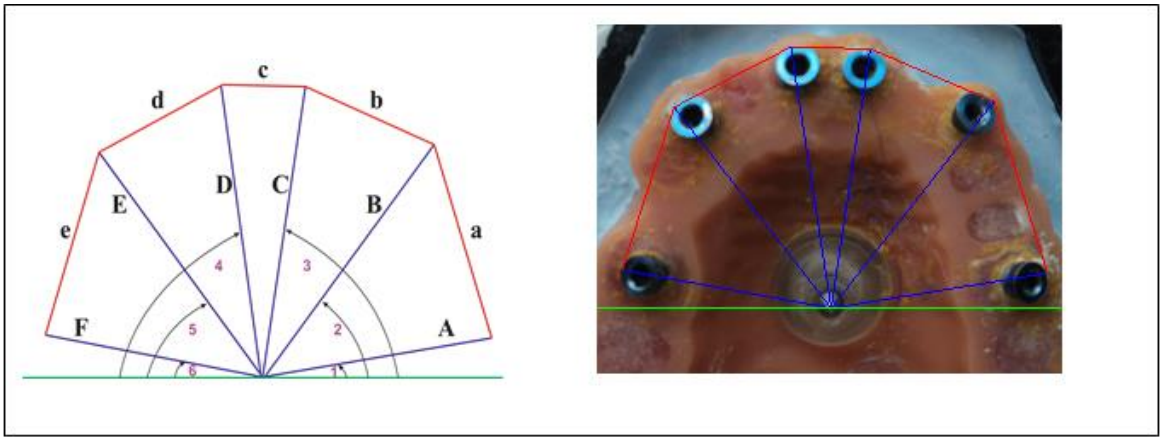


Figure (8): linear distances and angles measurements

1.Measure the distances that extended from the central reference point to the determined external reference points of (6) analogues (distances named: (A, B, C, D, E, F)

2. Measure the distances that extended between the determined external reference points of (6) analogues (named distances: a, b, c, d, e)

3. Measure angles that formed between the reference line and the lines that represent the six distances (A,B,C,D,E,F). Three angles at right side of the model named (1, 2, 3) with negative value, and three angles at left side named (4, 5, 6) with positive value as software program reading. An average of three readings for each measurement were recorded.The entire of measurements of the stone models were performed with coordination way (16), by which positions of analogues of the stone models were coordinate with the positions of the corresponding analogues of standard model in sequence. That mean, the first analogue of the stone model was coordinate with corresponding analogue of the standard model to locate exactly the determined external reference point on stone model, then the central reference points and the reference lines of both standard model and stone model which are consider as a fixed references were coordinate exactly to establish the correct measurements. The distances and angles of the stone model were measured .The coordination of the other analogues were repeated in the same way in sequence. The total number of impressions was ten. Five impressions for each technique, and ten stone casts were prepared. Statistically data was collected, means and standard deviation were calculated. One-sample t-test and two sample t-test were performed to determine significant difference at $p \leq 0.05$ level.

RESULTS & DISCUSSION

The results in Tables (1,2,3) showed means and standard deviation of the distances (A,B,C,D,E,F), distances (a, b, c, d, e,) and angles (1, 2, 3,4,5, 6) for both a new modified closed and open tray techniques.

Table (1): Means and standard deviation of linear distances (A, B, C, D, E, F) for both techniques

Distance	Standard model	Technique No	Modified closed tray Mean (mm)	SD±	Open tray Mean (mm)	SD±
A	28.785	5	27.3967	0.6679	26.8992	0.2167
B	34.643	5	32.4840	0.4711	32.6774	0.4149
C	34.389	5	33.0828	0.4862	32.6096	0.2370
D	34.743	5	32.9910	0.2463	33.2912	0.5898
E	34.084	5	32.2318	0.5423	32.1924	0.4545
F	28.335	5	27.1580	0.1437	27.2004	0.3305

No: number of samples, SD: standard deviation

Table (2): Means and standard deviation of linear distances (a, b, c ,d, e) for both techniques

Distance	Standard model	Technique No	Modified closed tray		Open tray	
			Mean (mm)	SD±	Mean (mm)	SD±
a	24.421	5	23.0124	0.1424	22.9348	0.2531
b	16.048	5	16.2968	0.8128	16.7292	0.1645
c	10.994	5	10.6046	0.3365	10.0292	0.5600
d	16.100	5	15.7598	0.2475	15.8058	0.2452
e	24.031	5	21.8320	0.4146	21.6642	0.3825

No: number of samples SD : standard deviation

Table (3): Means and standard deviation of angles (1, 2, 3, 4, 5, 6) for both techniques

Angles	Standard model	Technique No	Modified closed tray		Open tray	
			Mean (degree)	SD±	Mean (degree)	SD±
1	-8.4673	5	-10.1822	2.1145	-10.3762	1.0831
2	-53.375	5	-54.6438	3.4638	-54.1102	1.5914
3	-81.043	5	-84.2172	1.7235	-83.5712	2.3431
4	80.712	5	78.3236	2.9155	78.2944	1.4377
5	52.261	5	49.3088	3.1691	52.0088	3.2953
6	8.1035	5	8.70140	1.24357	7.08920	1.35743

No: number of samples, SD: standard deviation

Tables (4-9) showed the results of one sample T-test of the distances and angles between the standard model and stone models. The results appeared that there are a differences between the values but it is not statistically significant differences between both impression techniques and standard model. The values of all distances for both techniques were lower than that of standard model except distance (b) were higher than standard model. This result can be explained in that dental elastomeric impression materials are subject to several factors that can result in dimensional change. For example, the process of polymerization as with condensation-silicone, which involves cross-linking of the polymer chains, can result in a reduction of spatial volume, Although accuracy is affected by many factors, it should be realized that the magnitude of some of these changes may not be clinically significant, [17] as shown in Tables (4-7) the values of distances of stone models poured from condensation impression material with both techniques were lower than that of master model due to polymerization shrinkage of impression, but they are not significant differences.

Table (4): One-sample t-test for linear distances (A, B, C, D, E, F) between standard model and modified closed technique

Distance	Standard model	Technique No	Modified closed tray		T- test values	
			Mean (mm)	SD±	T-value	*P**
A	28.785	5	27.3967	0.6679	-0.00	0.999
B	34.643	5	32.4840	0.4711	0.00	1.000
C	34.389	5	33.0828	0.4862	-0.00	0.999
D	34.743	5	32.9910	0.2463	-2.41	0.074
E	34.084	5	32.2318	0.5423	-0.00	0.999
F	28.335	5	27.1580	0.1437	-0.00	1.000

*P**: means are statistically significant different at $p \leq 0.05$

Table (5): One-sample t-test for linear distances (A, B, C, D, E, F) between standard model and open tray technique

Distance	Standard model	Technique No	Open tray Mean (mm)	SD±	T- test values T-value	P*
A	28.785	5	26.8992	0.2167	0.00	0.998
B	34.643	5	32.6774	0.4149	0.00	0.998
C	34.389	5	32.6096	0.2370	-0.00	0.997
D	34.743	5	33.2912	0.5898	0.00	0.999
E	34.084	5	32.1924	0.4545	0.00	0.999
F	28.335	5	27.2004	0.3305	0.00	0.998

P*: means are statistically significant different at $p \leq 0.05$

Table (6): One-sample t-test for linear distances (a, b, c, d, e) between standard model and Modified closed tray technique

Distance	Standard model	Technique No	Modified closed tray Mean (mm)	SD±	T- test values T-value	P*
a	24.421	5	23.0124	0.1424	0.01	0.995
b	16.048	5	16.2968	0.8128	-0.00	1.000
c	10.994	5	10.6046	0.3365	-0.00	0.998
d	16.100	5	15.7598	0.2475	-0.00	0.999
e	24.031	5	21.8320	0.4146	0.00	1.000

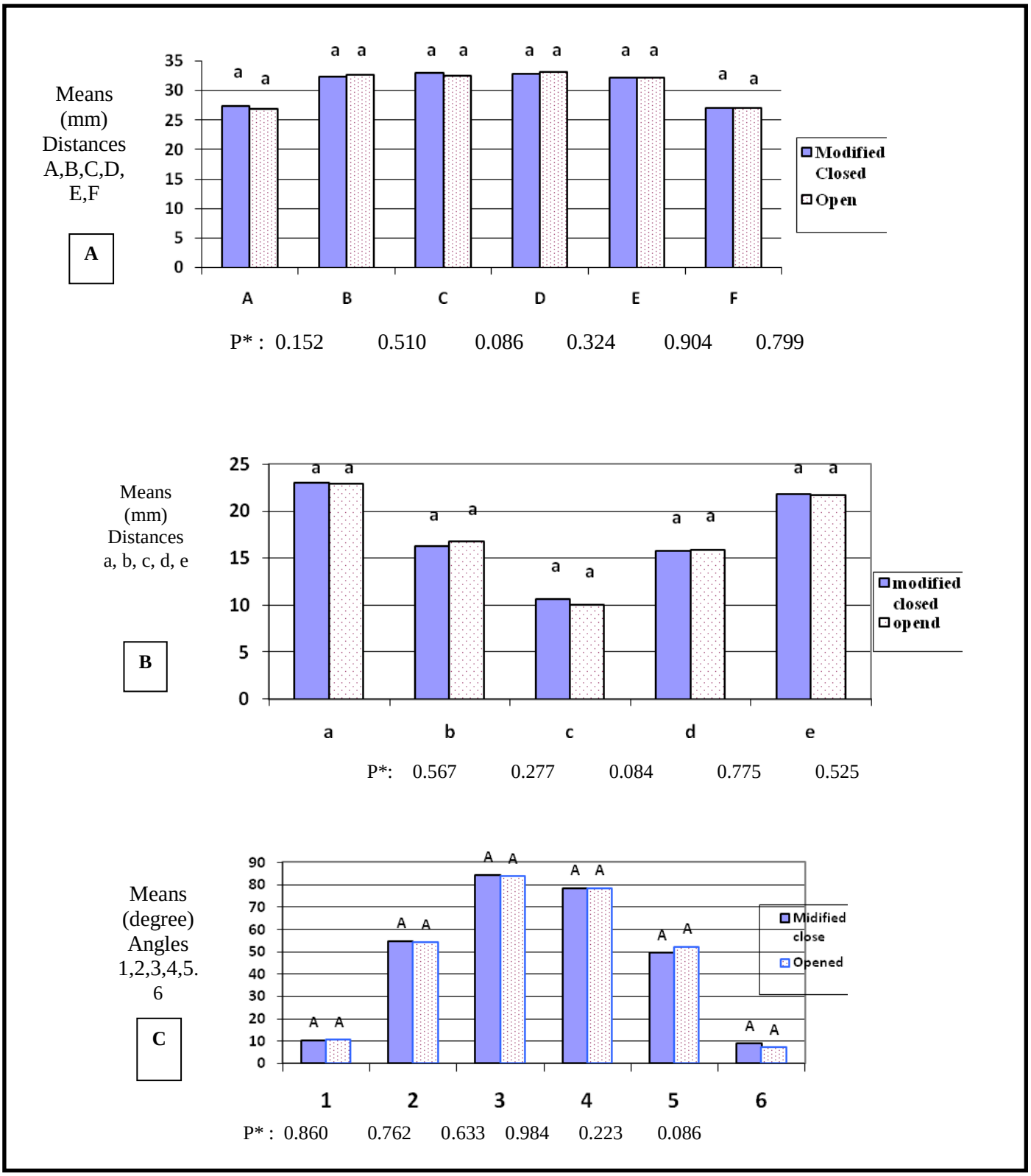
P*: means are statistically significant different at $p \leq 0.05$

Table (7): One-sample t-test for linear distances (a, b, c ,d, e) between standard model and open tray technique

Distance	Standard model	Technique No	Open tray Mean (mm)	SD±	T- test values T-value	P*
a	24.421	5	22.9348	0.2531	-0.00	0.999
b	16.048	5	16.7292	0.1645	0.00	0.998
c	10.994	5	10.0292	0.5600	0.00	0.999
d	16.100	5	15.8058	0.2452	-0.00	0.999
e	24.031	5	21.6642	0.3825	0.00	0.999

P*: means are statistically significant different at $p \leq 0.05$

Figure (9: A,B,C) showed the result of Two samples T-test of the distances and angles between the two tested impression techniques. The result appeared that there are no significant differences between the values for the both impression techniques.



*P**means with the same litter are statistically not significant different at $p \leq 0.05$

Figure (9): Two-samples t-test for linear distances and angles between modified closed and open tray technique (A, B, C)

The results in Tables (4-9) and Figure (9: A, B, C) indicate that a new modified close splinted technique with condensation silicone impression material that performed in this study is an accurate technique in linear distance registration as

same as the open technique in recording an impression of six angled implants at 25 degrees so the impression is accurate and removed easily without distortion of the impression material. These results can be explained in that the condensation silicone products demonstrated the best recovery from undercuts.[8]

Table (8): One-sample t-test for angles (1, 2, 3, 4, 5, 6) between standard model and Modified closed tray

Angles	Standard model	Technique No	Modified closed tray Mean (degree)	SD±	T- test values T-value	P*
1	-8.4673	5	-10.1822	2.1145	-0.00	0.998
2	-53.375	5	-54.6438	3.4638	-0.00	0.998
3	-81.043	5	-84.2172	1.7235	-0.01	-0.01
4	80.712	5	78.3236	2.9155	0.00	0.998
5	52.261	5	49.3088	3.1691	-0.00	0.999
6	8.1035	5	8.70140	1.24357	0.00	0.999

P*: means are statistically significant different at $p \leq 0.05$

Table (9): One-sample t-test for angles (1, 2, 3, 4, 5, 6) between standard model and open tray technique

Angles	Standard model	Technique No	Open tray Mean (degree)	SD±	T- test values T-value	P*
1	-8.4673	5	-10.3762	1.0831	-0.00	1.000
2	-53.375	5	-54.1102	1.5914	-0.00	1.000
3	-81.043	5	-83.5712	2.3431	-0.00	0.999
4	80.712	5	78.2944	1.4377	0.00	1.000
5	52.261	5	52.0088	3.2953	-0.00	0.999
6	8.1035	5	7.08920	1.35743	0.00	1.000

P*: means are statistically significant different at $p \leq 0.05$

The underlying principle of splinting is to connect all the impression copings together using a rigid material to prevent individual coping movement during the impression making procedure. [4,5] The splinted of each two angled implants separately with visible light cured acrylic resin were connect and fixed the two coping and also to minimize the shrinkage of the acrylic resin . Minimizing the shrinkage of the acrylic resin is the most important factor to ensure an accurate impression using the splint technique. [5] There is no previous studies to relate the result of this study to them.

CONCLUSION

A new modified closed splinted technique is an accurate impression technique for multiple angled (6) implants as same as the open tray technique with condensation silicon, so a new technique is an accurate and easier technique to be carried out with multiple angled non- parallel implants

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