Cumhuriyet Dental Journal 2017;20(1):30-39
Doi: 10.7126/cumudj.307293 *RESEARCH ARTICLES*

STORAGE CONDITION AND PERIOD EFFECT ON THE DIMENSIONAL STABILITY OF IRREVERSIBLE HYDROCOLLOID IMPRESSION MATERIALS

Saklama Şartlarının ve Sürelerinin İrreversible Hidrokolloid Ölçü Maddelerinin Boyutsal Stabilitesi Üzerine Etkileri

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Makale Kodu/Article code *: 84794*
Makale Gönderilme tarihi *: 07.04.2016*
Kabul Tarihi *: 17.03.2017*

ABSTRACT

The aim of this study was to evaluate the effects of brand, holding solution and storage periods on dimensional stability of irreversible hydrocolloid impression materials.

Impressions were taken from a master maxillary typodont, using a newly designed device and five different irreversible hydrocolloid impression materials. A total of 245 impressions were taken and divided into a control group, two main groups and three subgroups through storing procedure and time. Stone models were obtained for each model and five different dimensions were measured and compared to each other.

Comparison of the groups according to brand of irreversible hydrocolloid impression materials showed statistically significant differences. While the storage period was statistically important at all distances, storage condition was significant only at some distances.

Irreversible hydrocolloid impression materials can be stored in holding solution or sealed plastic bags up to two weeks. Type of the impression material, storage condition and storage period may affect dimensions.

Key words: Alginate impression, Dimensional stability, Holding solution, Orthodontic Model

ÖZ

Bu çalışmanın amacı marka, bekletme solüsyonu ve saklama süresinin irreversible hidrokolloid ölçü maddelerinin boyutsal stabilitesi üzerine etkilerinin incelenmesidir.

Ölçüler, yapay üst çene modelinden oluşturulmuş yeni bir cihaz yardımıyla beş farklı irreversible hidrokolloid ölçü maddesi kullanılarak alındı. Toplamda 245 adet ölçü saklama şartları ve süreleri dikkate alınarak kontrol grubu, iki ana grup ve üç alt gruba ayrıldı. Her bir ölçüden alçı modeller elde edildi, beş farklı uzunluk ölçüldü ve birbiri ile karşılaştırıldı.

İrreversible hidrokolloid ölçü maddesinin markasına göre yapılan gruplar arası karşılaştırma istatistiksel olarak anlamlı farklılıklar gösterdi. Saklama süresi tüm mesafe ölçümlerinde istatistiksel olarak anlamlı etki yaratırken iken saklama koşulları bazı mesafe ölçümlerinde anlamlı etkiye sahipti.

İrreversible hidrokolloid ölçü maddeleri bekletme solüsyonunda veyahut kilitli plastik torbalarda iki haftaya kadar bekletilebilir. Ölçü maddesinin tipi, saklama şartları ve saklama süresi boyutsal stabilite üzerinde etkilidir.

Anahtar kelimeler: Aljinat ölçü, Boyutsal stabilite, Bekletme solüsyonu, Ortodontik Model

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INTRODUCTION

Orthodontic treatment begins and ends with taking records such as patient history, photographs, radiographs and impressions. Impression is one of the most important pretreatment and post treatment records. At the beginning of the treatment, essential evaluations and measurements are performed on orthodontic models. Factors such as amount of crowding, arch shape, teeth relationship, molar relationship, jaws relationships, asymmetries and teeth shapes are determined on orthodontic models. Stone models are also used for making orthodontic appliances.[1] Although computer aided impression taking methods have been begun to use at last decade, most of the clinicians still prefer or use traditional method, as taking orthodontic impressions with irreversible hydrocolloids and using stone models.[1-3]

Irreversible hydrocolloid impression material is made from seaweed. When the powder of the material is mixed with water a gel formation is occurred and this reaction acts in an irreversible manner. The characteristics of irreversible hydrocolloid impression materials that produced by different commercial companies are important on clinical usage. Main clinical advantages of irreversible hydrocolloid materials are low cost, easy usage and good patient tolerance.[1-3] However, its low dimensional stability is main disadvantages of the material in clinical conditions. Water absorption and water release that occurs over time can cause dimensional distortions and hence inaccurate models.[1] Some factors such as type of impression material[4] and impression tray, storage condition and storage period can affect the dimensional stability of irreversible impression materials and hence the accuracy of diagnostic stone models. Quality of diagnostic stone models has a critical role in the orthodontic treatment plan and evaluation of the treatment results.[4,5]

The aim of this study was to evaluate the dimensional stability of five irreversible hydrocolloid impression materials according to the different storage condition and periods. The null hypothesis of this study was that the storage conditions and periods would not affect the dimensional stability of irreversible hydrocolloid impression materials.

MATERIALS AND METHODS

In the current study for the standardization of some main factors such as jaw, position of jaw, stable position of impression tray and pressure; a device named Dento that simulates the mouth was designed and produced by combining a maxillary typodont and carpenter equipment (BM1 Professional, Bosch, Germany). Position of the impression tray was stabilized with the help of two screws (Figure 1). Some reference points were made with a round bur on maxillary typodont (Figure 2).

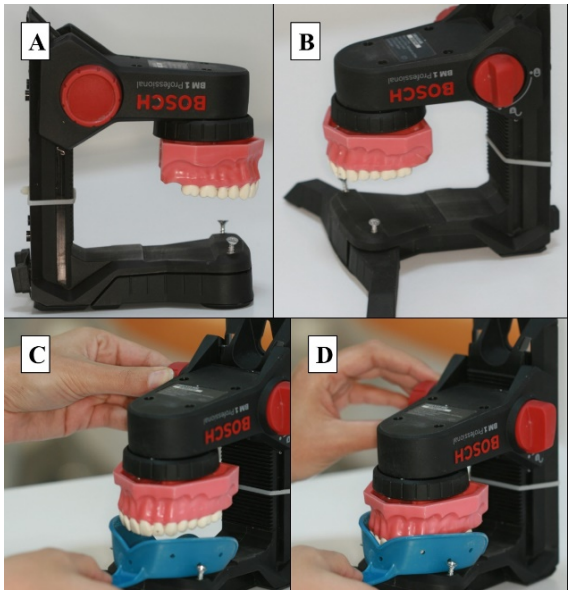

Figure 1. A) and B) Dento, C) and D) Imression process.

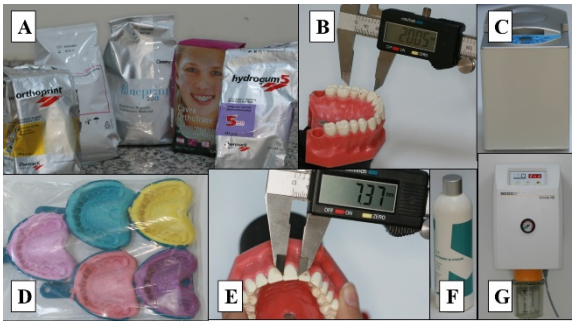

Figure 2. A)Irreversible hydrocolloid impression material brands, B) Digital caliper and Typodont, C) Irreversible hydrocolloid impression material mixing machine, D) Impressions, E) Measurement of dimensions, F) Holding solution, G) Gypsum mixing machine.

Five distances were determined based on developing previous studies.[6] These are;

1. Distance: Between mesiobuccal cusp tip of upper right molar and cusp tip of upper right canine.

2. Distance: Between distobuccal cusp tip of upper left molar and buccal cusp tip of upper left first premolar.

3. Distance: Between cusp tip of upper right canine and buccal cusp tip of upper left first premolar.

4. Distance: Between mesiobuccal cusp tip of upper right molar and distobuccal cusp tip of upper left molar.

5. Distance: Mesiodistal width of upper left central incisor.

Five different brand of alginate were included in this survey. Hydrogum 5(Zhermack, Badia Polesine, Italy), Palgat Plus Quick (3M ESPE, Seefeld, Germany), Blueprint (Dentsply Ltd., Weyhridge, England), Orthoprint (Zhermack, Rovigo, Italy), Orthorace (Cavex Holland BV, Haarlem, Netherlands) were tested at laboratory conditions (Figure 2). All of the impressions were taken with the same type and size of impression tray (O-Tray impression tray, Dentaurum, Germany) (Figure 1C and D). Alginates were prepared with an automatic alginate mixing machine (A.H.T.C.- MIX, Gulsa, Turkey) according to the manufacturers' instructions (Figure 2C and D). In this study, 245 alginate impressions (49 from each brand of alginate) were taken and 35 impressions (7 from each brand of alginate) were used as control group and poured within 20 minutes. Pouring procedure of impressions is standardized by using the same brand of gypsum and an automatic gypsum mixing machine (Motova 100, Bego, Bulgaria) (Figure 2G). Other 210 impressions were divided into two main groups. First group was stored in a holding solution (Extend a pour solution, Dux dental, USA) and second group was stored in sealed plastic bags like previous study.[5] Each groups included equal number of impressions from each brands of impressions. Then main two groups were divided into three subgroups according to storage periods. All of subgroups were named and names were given at Table 1.

Table 1. Subgroups and their abbreviations used in Tables 2-8.

	Control	One day storage in sealed plastic bag	Five days storage in sealed plastic bag	Two weeks storage in sealed plastic bag	One day storage in holding Solution	Five days storage in holding Solution	Two weeks storage in holding Solution
Orthoprint (Zhermack)	OZ	OO	OF	OT	OSO	OSF	OST
Palgat Plus Quick (3M Espe)	PZ	PO	PF	PT	PSO	PSF	PST
Cavex Orthotrace (Cavex)	CZ	CO	CF	CT	CSO	CSF	CST
Blueprint X-rex (Densplay)	BZ	BO	BF	BT	BSZ	BSF	BST
Hydrogum 5 (Zhermack)	HZ	HO	HF	HT	HSO	HSF	HST

These storage periods were 24 hours, 120 hours and 336 hours. The subgroups were poured in gypsum in order to compare the dimensional changes of alginate impression materials[7] at the end of the storage periods. Pouring of impressions is standardized by using same brand of gypsum (Amberok Model Stone, ADD, Turkey) with control group and automatic gypsum mixing machine. All of the stone models were divided in 35 groups and given numbers. Five distances were determined between reference points and measured on all of the stone models.

At the end of the study, all of stone models of a subgroup and maxillary typodont was

scanned with digital scanner (3Shape TRIOS® Ortho, 3Shape, Denmark). These digital models were prepared and analyzed with proper computer program(Ortho Analyzer™ Software, 3Shape, Denmark). All measurements were repeated on these models and results were compared (Figure 3).

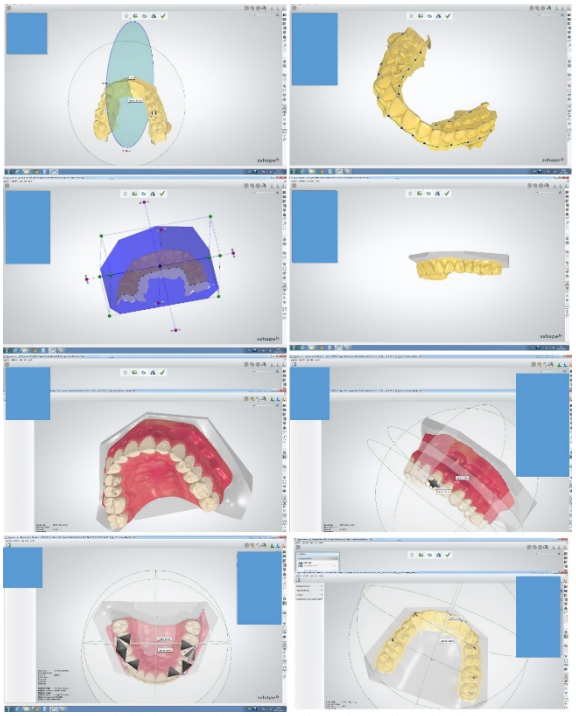

Figure 3. Digital models prepared and analyzed with computer program.

Research data were statistically analyzed and computational works were performed using statistical software (SPSS 17.0 V; SPSS Inc., Chicago, IL, USA). Statistical tests were made using three way ANOVA and significance was evaluated at $p<0.05$.

RESULTS

The measurements of distances on the master model and on control groups were shown at Table 2. All of the measurements made on control groups were very close to master model dimensions.

Table 2. Mean values of distances of control groups (mm).

Group			Mean value		
	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
Model	19,48	16,52	37,38	51,16	8,09
OZ	19,23	16,32	37,36	51,12	8,03
PZ	19,32	16,38	37,26	50,84	7,98
CZ	19,38	16,25	37,39	50,91	7,92
BZ	19,45	16,48	37,32	50,89	8,05
HZ	19,44	16,51	37,20	51,05	7,98

Evaluation of the measurements of one day, five day and two weeks storages in sealed plastic bag groups and holding solution groups were showed that the all of the brands of the alginate materials were contracted at different amounts (Table 3-8).

Table 3. Mean values of distances of One day storage in sealed plastic bags groups (mm).

Group			Mean value		
	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
Model	19,48	16,52	37,38	51,16	8,09
OO	19,07	16,07	37,18	50,60	7,82
PO	19,17	16,21	36,60	49,51	7,59
CO	19,12	16,27	36,91	50,32	7,90
BO	19,18	16,09	37,46	50,51	7,90
HO	19,06	16,01	37,15	50,56	7,84

Table 4. Mean values of distances of five days storage in sealed plastic bags groups (mm).

Group			Mean value		
	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
Model	19,48	16,52	37,38	51,16	8,09
OF	19,05	16,26	36,93	50,51	7,86
PF	19,30	16,10	37,21	50,69	7,45
CF	19,06	16,01	37,01	50,47	7,87
BF	19,22	15,91	37,24	50,81	7,54
HF	19,25	16,20	37,35	50,80	7,47

Table 5. Mean values of distances of two weeks storage in sealed plastic bags groups (mm).

Group			Mean value		
	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
Model	19,48	16,52	37,38	51,16	8,09
OT	19,06	16,02	37,18	50,65	7,29
PT	19,12	16,05	37,05	50,45	7,39
CT	19,30	16,02	36,87	50,55	7,69
BT	19,16	16,10	36,83	50,32	7,36
HT	18,91	15,84	36,91	50,38	7,83

Table 6. Mean values of distances of one day storage in holding solution groups (mm).

Group	First Distance	Second Distance	Mean value Third Distance	Fourth Distance	Fifth Distance
Model	19,48	16,52	37,38	51,16	8,09
OSO	18,93	15,96	36,90	50,17	7,61
PSO	19,07	15,98	36,35	50,28	7,85
CSO	19,18	16,19	37,02	50,40	7,88
BSO	19,17	16,04	37,36	50,70	7,66
HSO	19,10	15,95	37,10	50,46	7,92

Table 7. Mean values of distances of five days storage in holding solution groups (mm).

Group	First Distance	Second Distance	Mean value Third Distance	Fourth Distance	Fifth Distance
Model	19,48	16,52	37,38	51,16	8,09
OSF	19,07	16,31	37,06	50,65	7,80
PSF	19,19	15,95	36,79	50,07	7,88
CSF	19,12	16,24	36,90	50,33	7,89
BSF	19,28	16,27	36,80	49,99	7,86
HSF	19,27	16,07	36.97	50,72	7,49

Table 8. Mean values of distances of two weeks storage in holding solution groups (mm).

Group	First Distance	Second Distance	Mean value Third Distance	Fourth Distance	Fifth Distance
Model	19,48	16,52	37,38	51,16	8,09
OST	19,05	16,29	36,99	50,49	7,82
PST	19,07	15,99	36,69	50,27	7,68
CST	19,10	16,16	37,11	50,51	7,80
BST	19,06	15,97	36,83	50,37	7,85
HST	19,11	16,03	36,83	50,45	7,45

Tests of between-subjects effects showed that the effects of brands and storage periods on first, second, third, fourth and fifth distance are statistically significant ($p<0.05$). In addition, storage condition is statistically significant in all dimensions except second distance ($p<0.05$) (Table 9).

Table 9. Tests of Between –Subjects Effects

Tests of Between –SubjectsEffects	DependentVariable				
	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
	P valu	P value	P value	P value	P value
Brands of Irreversible Hydrocolloid Impression Materials	,000	,030	,000	,000	,000
Storage Conditions	,024	,408	,000	,000	,000
Storage Periods	,010	,001	,013	,000	,000
Brands of Irreversible Hydrocolloid Impression Materials * Storage Conditions	,002	,000	,000	,001	,000
Brands of Irreversible Hydrocolloid Impression Materials * Storage Periods	,000	,000	,000	,000	,000
Storage Conditions * Storage Periods	,027	,000	,078	,019	,000
Brands of Irreversible Hydrocolloid Impression Materials * Storage Conditions * Storage Periods	,000	,000	,016	,000	,000

*P<0,05 indicates significant difference.

When the Pairwise Comparisons of brands of Alginate materials were evaluated, following statistical results were identified (Table 10);

Table 10. Pairwise Comparisons of Brands

Pairwise Comparisons of Brands	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
Groups	P value	P value	P value	P value	P value
Control(Model) Orthoprint	,000	,000	,006	,000	,000
Palgat Plus	,000	,000	,000	,000	,000
Orthorace	,002	,000	,000	,000	,000
Blueprint	,000	,000	,034	,000	,000
Hydrogum	,000	,000	,003	,000	,000
Orthoprint Control	,000	,000	,006	,000	,000
Palgat Plus	,003	,042	,000	,000	,033
Orthorace	,000	1,000	1,000	,545	,000
Blueprint	,000	,624	1,000	1,000	1,000
Hydrogum	,018	,019	1,000	1,000	,938
Palgat Plus Control	,000	,000	,000	,000	,000
Orthoprint	,003	,042	,000	,000	,033
Orthorace	,474	,144	,000	,000	,000
Blueprint	1,000	1,000	,000	,000	,050
Hydrogum	1,000	1,000	,000	,000	1,000
Orthorace Control	,002	,000	,000	,000	,000
Orthoprint	,000	1,000	1,000	,545	,000
Palgat Plus	,474	,144	,000	,000	,000
Blueprint	1,000	1,000	,284	1,000	,000
Hydrogum	,126	,071	1,000	,107	,000
Blueprint Control	,000	,000	,034	,000	,000
Orthoprint	,000	,624	1,000	1,000	1,000
Palgat Plus	1,000	1,000	,000	,000	,050
Orthorace	1,000	1,000	,284	1,000	,000
Hydrogum	1,000	1,000	1,000	,262	1,000
Hydrogum Control	,000	,000	,003	,000	,000
Orthoprint	,018	,019	1,000	1,000	,938
Palgat Plus	1,000	1,000	,000	,000	1,000
Orthorace	,126	,071	1,000	,107	,000
Blueprint	1,000	1,000	1,000	,262	1,000

*p<0.05 indicates significant difference.

-Dimensional differences between model and all subgroups were statistically significant at all five distances ($p<0.05$).

-Measurements on first distance showed that Orthoprint subgroups' dimensions showed statistically significant differences from other brands of Alginate ($p<0.05$).

-There are statistically significant differences between Orthoprint and other two brands of Alginate (Palgat Plus Quick and Hydrogum) according to measurements on second distance ($p<0.05$).

-Statistical comparison of third and fourth distances' measurements indicated that the differences between Palgat Plus Quick and other brands of Alginates are significant ($p<0.05$).

-Hydrogum subgroups' distances did not show statistically significant changes ($p>0.05$) although comparison of other subgroups show statistically significant changes ($p<0.05$).

Pairwise Comparisons of storage periods showed following results (Table 11);

Table 11. Pairwise Comparisons of Storage Periods

Pairwise Comparisons of Storage Periods					
	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
Groups	P value	P value	P value	P value	P value
Control Oneday Fivedays Twoweeks	,000 ,000 ,000	,000 ,000 ,000	,000 ,000 ,000	,000 ,000 ,000	,000 ,000 ,000
Oneday Control Fivedays Twoweeks	,000 ,015 1,000	,000 ,078 1,000	,000 1,000 ,530	,000 ,000 ,000	,000 ,000 ,000
Fivedays Control Oneday Twoweeks	,000 ,015 ,518	,000 ,078 ,001	,000 1,000 ,019	,000 ,000 ,439	,000 ,000 ,000
Twoweeks Control Oneday Fivedays	,000 1,000 ,518	,000 1,000 ,001	,000 ,530 ,019	,000 ,000 ,439	,000 ,000 ,000

*p<0.05 indicates significant difference.

-Control groups' results are statistically significant than other storage periods (one day and five days) ($p<0.05$).

-On first distance, statistically significant differences were identified between one day and five day storage periods ($p<0.05$).

-There are significant differences between 5 days and two weeks storage periods on second, third, fourth and fifth distances ($p<0.05$).

-Differences between all three storage periods are statistically different on fifth distance measurements ($p<0.05$).

Pairwise Comparisons of Storage conditions showed following results (Table 12);

Table 12. Pairwise Comparisons of Storage Conditions

Pairwise Comparisons of Storage Conditions					
	First Distance	Second Distance	Third Distance	Fourth Distance	Fifth Distance
Groups	P value	P value	P value	P value	P value
Control Plastic bag Solution	,000 ,000	,000 ,000	,000 ,000	,000 ,000	,000 ,000
Plastic bag Control Solution	,000 ,071	,000 1,000	,000 ,000	,000 ,000	,000 ,000
Solution Control Plastic bag	,000 ,071	,000 1,000	,000 ,000	,000 ,000	,000 ,000

*p<0.05 indicates significant difference.

-Comparisons of control groups (poured within 20 minutes) and other storage conditions' groups (sealed plastic bag and holding solution) showed statistically significant differences on all distances ($p<0.05$).

-Comparison of sealed plastic bag groups and holding solution groups did not show statistical differences on first and second dimension. On the other hand other three distances show statistical differences ($p<0.05$).

Comparison of digital and manual measurements' results showed than there are not statistically significant differences between these two methods.

DISCUSSION

The null hypothesis of this study was rejected since the storage conditions and periods were effective on the dimensional stability of irreversible hydrocolloid impression materials.

Type of impression trays and shape of the impression can affect the dimensional stability and the dimensional changes.[8,9] In previous studies artificial models were used as a master model in order to produce more accurate points for measurement and evaluation.[10,11] In the present study, sizes of impressions and master model were identical because same typodont and same impression trays were used.

It was known that mixing method has significant effect on mechanical properties of

alginate impression materials.[12] In the present study mixing method was standardized and the manufacturers' recommendations were followed. Stabilization of impression trays were ensured with two screws positioned on the base of the Dento. Equal pressure was applied while taking all impressions due to the appliance design. Stone models of all groups were produced with using same brand of gypsum and gypsum-mixing machine. Distances measured on all of the stone models were same and reflect the impressions' dimensions well. Storage conditions of the impressions were appropriate to study parameters. Storage periods were convenient to the clinical applications and results of study were beneficial for clinicians. Plaster study models were found reproducible.[13] Moisture and dry can affect the dimensions but they are not adverse effective factors on the dimensional stability of irreversible hydrocolloids.[14] In the present study, storing conditions of all stone models were the same.

As a result, proper comparisons of dimensional changes of the impressions were made. Study parameters were also suitable for use of orthodontic models. Statistical analysis was proper for study parameters and compatible with other studies made on this subject.

All of the measurements on control groups were very close to master model dimensions. This result was inevitable because it is recommended that the impressions should be poured within 30 minutes for best copy of the master model or mouth. Present study's results were also supported by literature.[15] In a study that evaluates the relationship between pouring time and dimensional accuracy, it was found that the hydrocolloid impression materials can be stored up to an hour without significant dimensional changes.[15] In same study, impressions were poured after 12 minutes, 30 minutes and an hour storage periods.[15] On one hand, some authors recommend pouring alginate within ten minutes. On the other hand, other study results presented that it can be poured within 30 minutes without significant dimensional changes.[16]

In the comparisons of effects of brand of alginate impression materials on dimensions of orthodontic models at first, second, third, fourth and fifth distances were showed that there are some statistically significant differences between groups. But the results were not uniform. Literature supports these results; there is a non-uniform relationship between alginate brand and storage time and also is significant effects of alginate brand on model dimensions.[17,18] However some studies opposed with this result; all types of irreversible hydrocolloids were dimensionally stable over a extended period.[19] In addition a study about the dimensional stability of alginate was concluded that the extended storage periods affects the dimensions but the effect is not statistically significant.[20,21]

In the present study, one day storage in sealed plastic bag caused contraction of all impressions on different amounts but this contraction was approximately 0.5 mm. This contraction can affect the model dimensions but the quality of the orthodontic models was proper for evaluation of patients. Coleman *et al*.[22] evaluated the effects of immediate pour, 10 minutes storage, 30 minutes storage, 1 hour storage and 24 hour storage on dimensions of hydrocolloid impressions and stated that one day storage caused bad effects on the dimensions of impressions. In another study, Nassar *et al.*[23] stated that four hours of storage period caused under 0.5% dimensional changes on impressions.

According to the present study's results; storage of impressions in plastic bags during five days caused dimensional changes on impressions in which the maximum dimensional contraction was less than 1 mm. This maximum value can disrupt some results of detailed orthodontic evaluation like Bolton analysis but general stone model quality may be enough for diagnostic examination. When the

literature was evaluated, some studies showed that longer storage time can cause unstable impression dimensions.[24] However, another study results showed that storage periods up to 5 days did not change the dimensions of impression at statistically significant level.[25] In addition, in a study which evaluated that the relationship between model accuracy and storage time, it was concluded that the four days storage period in sealed plastic bags did not differ the accuracy of models.[6] On the other hand, another study showed that statistically significant dimensional differences were determined between one day storage, three days storage and five days storage groups. So storage time is a determinant on the dimensional changes of alginate.[26]

According to present study's results; two weeks storage period affect the model quality badly on sealed plastic bag group but the maximum dimensional deviation from the original master model was less than 1 mm like five day storage period. Longer storage period provoked more contraction of impressions. However quality of the stone models were almost alike five days storage periods. There is no study at the literature about two week's storage period so this is the first result about two weeks storage of Alginate impressions.

In present study, comparison of the storage condition (sealed plastic bag via holding solution) showed statistically significant differences between groups on third, fourth and fifth dimension. One day, five days and two weeks storage in holding solution were resulted in varying amounts of contractions of impressions. However, contractions were around 0.5 mm.

Storage temperature may have an effect on dimensions of impressions.[19] In present study, impressions were stored same place and the temperature at room temperature. So the effect of temperature was eliminated.

In an experimental study, It was shown that the weight of alginate increased initially maximum and then decreased. It means alginates take the water or other liquid inside firstly, then give them to outside. Alginate firstly expanded by external liquid then contracted by reversed thermodynamic potential.[27] This study's results are compatible with present study's result which shows that alginate impression materials contractions are not uniform.

Present study's results showed that the alginate is not a uniform material and should be used carefully. Storage time, storage condition and alginate brand can affect the dimensional stability of impressions. On the other hand these effects are at small level and mostly may not change the orthodontic model accuracy.

Comparison of digital and manual impression taking methods showed no statistically significant differences. Digital measurements of five distances gave similar results with manual method at which digital caliper was used. Computer aided digital impression taking methods can reduce the chair time and increase patient comfort. Clinicians do not use gypsum, alginate or impression and do not need a technician and storage area due to digital impression technology. These are main advantages of digital impressions. On the other hand quality of work in the limit of study parameters are not more than conventional ones.

This study has some limitations. Under the same experimental conditions the effects of different factors on dimensional changes of irreversible hydrocolloid impression materials should be made in future investigations.

Today, despite new impression taking technologies being available especially in developed countries, many of clinicians mainly working in private practice are continuing to use Alginate for taking impressions and sending them to orthodontic laboratories. Day by day new brands of Alginate with new characteristics are been developing and producing. New products like holding solution also are taking in

market. So researchers should test them and present the results to help clinicians.

CONCLUSIONS

- Extended storage time may cause dimensional changes on the alginate impressions.
- Alginate impressions can be stored in holding solution or sealed plastic bags up to two weeks without too much clinically effective stability problems.

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