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IP Annals of Prosthodontics and Restorative Dentistry

Journal homepage: https://www.aprd.in/

Original Research Article

Comparative evaluation of the dimensional accuracy of two commercially available extended pour alginates and a conventional alginate impression material at various time intervals – An in vitro study

Tazeen Raees[1], Usha Radke[2], Saee Deshpande[2]*, Neelam Pande[2], Shachi Alsi[2]

[1]*Clinician and Private Practitioner, United Kingdom*
[2]*Dept. of Prosthodontics, Ranjeet Deshmukh Dental College and Research Centre, Nagpur, Maharashtra, India*

ARTICLE INFO

Article history:
Received 07-12-2023
Accepted 09-01-2024
Available online 16-03-2024

Keywords:
Dimensional accuracy
Alginate
Extended pour
Commercial

ABSTRACT

Introduction: Because of its acceptable accuracy, affordable price, accessible availability, and simplicity of handling, alginate impression materials continue to be a crucial component of dental practice despite many developments.

Aim: The purpose of this study was to evaluate and compare the dimensional accuracy of two commercially available extended pour alginates (Cavex ColorChange and Algeniux) and a conventional alginate impression material (Zelgan) at different time intervals.

Materials and Methods: On a maxillary model (Columbia Dentoform, Long Island City, N.Y.) the canines and the first molars were replaced with metal dies. This was selected as the master model. A '+' mark was inscribed on these metal dies to serve as a reference for measurements. A self-cure acrylic resin custom tray was fabricated such that it was positioned over the model in the same spatial relationship with equal amount of space between the tray and model every time an impression was made. A total of 180 impressions were made of the master model, 15 impressions with each material at four different time intervals; immediate, 30 minutes, 48 hours (2 days) and 120 hours (5 days) to obtain gypsum cast. Manufacturer recommended water/powder ratios and storage conditions were followed in the process. Following the designated storage time interval, the casts were poured in minimum expansion Type IV dental stone. Measurements were done with a coordinate measuring machine after 7 days when the casts were completely dry.

Results: To evaluate and compare the dimensional accuracy of materials across various time points, for each group, the mean and standard deviation were estimated and subjected to statistical analysis. Two Way Repeated Measure Analysis of Variance (ANOVA) was performed to determine if the dimensions differed significantly across groups with time. The pair wise analysis for materials and time points was performed using Tukey's post-hoc test. The p value was taken as significant when less than 0.05.

Across different time points, a minimum % change was observed at immediate time point, which gradually increased at 30 minutes and at 48 hour, but at 120 hour the % change was maximum for all dimensions. Among three groups, Cavex ColorChange material showed minimum % change across time points, whereas Zelgan group showed maximum % change across all dimensions.

All the paired differences were statistically insignificant ($p > 0.05$) for Algeniux and Cavex ColorChange group. But for Zelgan group, the difference between all the pairs of time points were statistically significant ($p < 0.05$), except for the pair immediate vs. 30 minutes. These results suggest that Zelgan material showed significant changes after 30 min for all the dimensions.

Conclusion: The results revealed that both the extended pour alginates Cavex ColorChange and Algeniux produced dimensionally accurate casts at all time intervals while the conventional alginate, Zelgan was accurate only at immediate and 30-minute time interval. It was also observed that, among the 4-time intervals investigated, most accurate casts were obtained when the impressions were poured immediately.

https://doi.org/10.18231/j.aprd.2024.007

1. Introduction

Dimensional accuracy and stability are two most important requirements for an impression material. A precise impression is a necessary to ensure the accuracy of gypsum casts for a well-fitting removable or fixed prosthesis.[1]

In spite of various advancements, alginate impression material still remains an indispensable part of dental practice because of their acceptable accuracy, reasonable cost, easy availability and ease of handling.[2–4]

Various researchers have recommended that in order to maintain the dimensional accuracy, alginate impressions should be poured immediately or at most within 30 minutes.[5,6] However, because of time constraints, most clinicians do not pour their impressions immediately, but instead, send them to the laboratory for making casts.[7]

The usual practice is to keep these impressions in a damp paper towel for shipping to the laboratory.[2] It has been studied that wrapping an impression in a wet paper towel is not an acceptable alternative to pouring the impression immediately. It results in distortion of impressions due to uneven weight or pressure from the towel or due to imbibition of moisture from the wet paper towel.[7] This delay in impression pouring and lack of appropriate storage conditions are the most common causes for inaccurate casts. To overcome these problems, recently, several manufacturers have developed alginate impression materials which claim to have a dimensional stability of up to 120 hours. These are called as 'extended pour' or '100-hour alginates. With extended pour alginates, impression pouring can be extended over a time period as specified by the manufacturers. These impressions are stored either in a sealed plastic bag or wrapped in damp paper towel.[8]

Considering the lack of adequate evidence-based data on dimensional accuracy of extended pour alginates and controversial results of the available studies, the present study was designed to assess the effect of storage time on the dimensional accuracy of commercially available conventional and extended-pour alginates. This comparative analysis will help the clinician in selecting a cost-effective material which is more stable over time in order to improve the accuracy of the casts used to fabricate prosthesis and appliances.[9]

2. Materials and Methods

This study was carried out to evaluate and compare the dimensional accuracy of two commercially available extended pour alginates and a conventional alginate impression material at various time intervals.

The materials used in the study were two Extended Pour Alginate Impression Materials, Cavex ColourChange (Cavex, Holland) and Alginiux (Major, Italy) and a conventional alginate impression material, Zelgan (Dentsply).

The methodology was as follows:

2.1. Preparation of metal dies

The canines and first molars of a maxillary model (Columbia Dentoform, Long Island City, N.Y.) were replaced with metal dies with flat occlusal surface on which grooves was scribed extending to the edge making a plus '+' sign. The four end points of the '+' served as a standard for measurements with CMM to obtain the center (reference point) of each die. (Figure 1)

2.2. Fabrication of a tray positioning device and the custom tray

A tray positioning device was designed to position the tray on the model in the same spatial relationship while making the impressions. (Figure 2)

Three metal rods with vertical stops were fixed, one placed anteriorly and two placed posterior to the master model. The vertical stops prevented the apical displacement of the impression trays and at the same time maintained an even thickness of impression material between the tray and the model.

Self-cure perforated acrylic tray with 3 handles was fabricated for making impressions (Figure 3).

2.3. Making the impressions

The impression materials (Cavex ColorChange, Algeniux, Zelgan) and Type IV dental stone (Ultrarock, Kalabhai Karson Pvt. Ltd., Mumbai) were weighed using high accuracy balance and transferred to zip-lock pouches and sealed.

Measured amount of distilled water and pre weighed packet of the alginate were added into the rubber bowl and mixed for approximately 30-45 seconds (depending on the manufacturer's instructions) until a smooth homogenous creamy mix was obtained. Then the material was loaded on the tray which was then positioned on the device to make the impression of the master model. The impression was removed with a quick snap and evaluated for any defects. If acceptable, the impression was rinsed with distilled water and used further for pouring casts (Figure 4).

A total of 180 impressions were made, 15 impressions with each material at 4 time intervals:

1. Immediate
2. 30 minutes
3. 48 hours (2nd day)
4. 120 hours (5th day)

* *Corresponding author*.
E-mail address: drsaeedeshmukh1181@gmail.com (S. Deshpande).

2.4. Storage of impressions

Impressions which were not poured immediately were stored according to manufacturer's instructions. These were stored in an incubator (Lyzer, India) with the temperature adjusted to 24ºC to simulate room temperature.

2.5. Pouring the impressions and making models

The impressions were poured using measured amounts of distilled water and type IV dental stone. The models were examined to be free of any voids and bubbles. If acceptable, they were labeled, and further measurements were carried out.

2.6. Measurements of the samples (Plate VII)

All 180 samples were measured for linear and cross-arch dimensions with a coordinate measuring machine (CMM Crysta-Apex C 544, Mitutoyo, USA) with an accuracy of up to 0.001mm (Figure 6). Four reference points were taken on the metal die named as, A (Right canine), B (Left canine), C (Left first molar) and D (Right first molar).

Reference points of each sample were obtained by contacting the end points of the scribed lines i.e., '+' on the casts with the ruby probe of CMM. This gave the center of each die which was taken as the reference point for measurements.

Using these references points, all linear and cross arch dimensions of the casts and master model were calculated. (Figure 5).

For each dimension, three readings were taken. The mean of the three was considered as the final reading.

2.7. Total of six dimensions were measured between the four reference points (Figure 6)

The measurements of the original model were:

A-B: 32.1922 mm
B-C: 22.039 mm
C-D: 46.7581 mm
D-A: 21.9198 mm
A-C: 44.7385 mm
B-D: 44.4427 mm

Once the readings of all samples were obtained, percentage of dimensional change was calculated using the formula:

% Dimensional change = Change in dimensions/Original dimensions x100

Values greater than 0.5% of dimensional change were considered as clinically not acceptable.[7]

3. Results

The data for percentage of dimensional change was obtained for all groups. To evaluate and compare the dimensional accuracy of materials across various time points, for each group the mean and standard deviation were estimated and subjected to statistical analysis.

Figure 1: Maxillary master model with metal dies

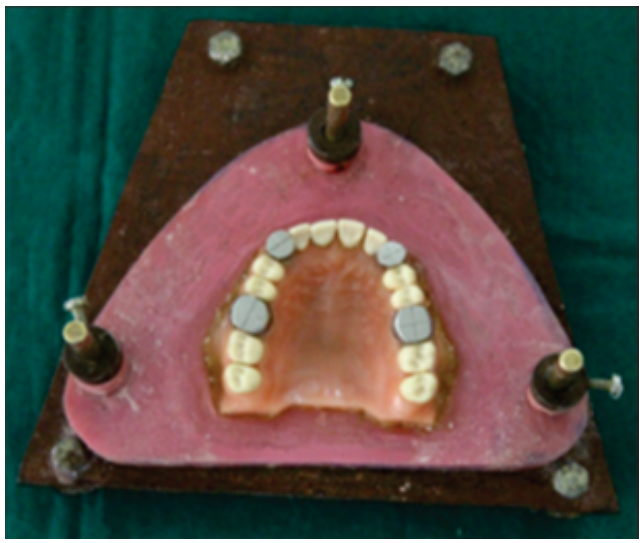

Figure 2: Model mounted on tray positioning device

3.1. Statistical analysis

The analysis was performed using SPSS version 20.0 (SPSS Inc.). Two Way Repeated Measure Analysis of Variance (ANOVA) was performed to determine if the dimensions differed significantly across groups with time. The pair wise analysis for materials and time points was performed using Tukey's post-hoc test. The p value was taken as significant when less than 0.05.

Table 1: Descriptive statistics for % change in dimensions for three groups at each time point

Groups	Time point	% Change in Dimensions [Mean ± SD]					
		AB	DA	CD	BC	BD	AC
Cavex Color Change	Immediate	0.1099 ± 0.0678	0.1292 ± 0.0722	0.101 ± 0.0296	0.1815 ± 0.0689	0.112 ± 0.0275	0.1043 ± 0.0295
	30 minutes	0.1221 ± 0.0397	0.1447 ± 0.0783	0.1185 ± 0.0304	0.2043 ± 0.0686	0.1163 ± 0.0307	0.1164 ± 0.0305
	48 hour	0.1501 ± 0.0624	0.1615 ± 0.0762	0.1283 ± 0.0511	0.2157 ± 0.0586	0.1304 ± 0.0415	0.1275 ± 0.0346
	120 hour	0.1524 ± 0.047	0.1832 ± 0.0761	0.1344 ± 0.0527	0.2282 ± 0.0621	0.1343 ± 0.0424	0.1289 ± 0.0369
Algeniux	Immediate	0.109 ± 0.0272	0.1139 ± 0.0659	0.0997 ± 0.0387	0.1731 ± 0.0691	0.1002 ± 0.0311	0.0985 ± 0.0335
	30 minutes	0.1141 ± 0.0324	0.1418 ± 0.0747	0.1109 ± 0.0279	0.1951 ± 0.0496	0.1126 ± 0.0355	0.1146 ± 0.0308
	48 hour	0.1391 ± 0.055	0.1509 ± 0.0741	0.1282 ± 0.0481	0.2186 ± 0.0519	0.1267 ± 0.0435	0.1188 ± 0.0374
	120 hour	0.1418 ± 0.0587	0.1700 ± 0.0771	0.1328 ± 0.0407	0.2219 ± 0.0522	0.1337 ± 0.0383	0.1231 ± 0.0418
Zelgan	Immediate	0.1227 ± 0.0304	0.1397 ± 0.0542	0.1064 ± 0.032	0.1848 ± 0.0579	0.1046 ± 0.0322	0.1013 ± 0.0299
	30 minutes	0.1311 ± 0.0318	0.1492 ± 0.0447	0.1213 ± 0.0336	0.2116 ± 0.0551	0.1171 ± 0.0382	0.1148 ± 0.0382
	48 hour	0.594 ± 0.0632	0.5237 ± 0.4265	0.4187 ± 0.0554	0.6068 ± 0.1646	0.502 ± 0.0702	0.4826 ± 0.0515
	120 hour	0.7074 ± 0.044	0.6881 ± 0.3714	0.5134 ± 0.0724	0.7737 ± 0.0899	0.5673 ± 0.0508	0.5427 ± 0.0327

SD: Standard Deviation

Figure 3: Self-cure acrylic impression tray positioned over the model

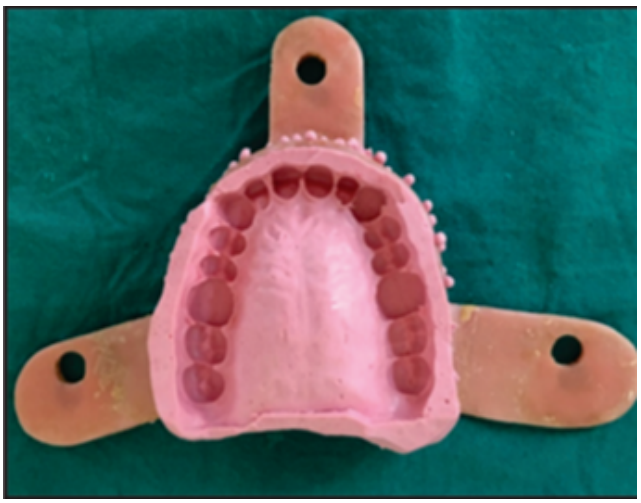

Figure 4: Impression made

3.2. Descriptive statistics

Table 1 provides the descriptive statistics for percentage change in dimensions according to different time points for three material groups.

In the Cavex ColorChange category, for dimension AB, the mean % change was 0.1099 ± 0.0678 at immediate time point, which gradually increased with time and was the highest at 120 hours i.e. 0.1524 ± 0.047. Similarly, In Algeniux group, dimension AB showed highest % change at 120 hours with a mean of 0.1418 ± 0.0587. As compared to these two groups, the mean % change in dimension AB was higher across all time points in Zelgan group, and at

Table 2: Pairwise comparison between groups at different time points using Tukey's post-hoctest

Dimensions	Comparisons	Simple main effect (P-value) Time points			
		Immediate	30 minutes	48 hour	120 hour
AB	Cavex Color Change vs. Algeniux	-	-	0.9999 (NS)	0.9999 (NS)
	Cavex Color Change vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
	Algeniux vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
DA	Cavex Color Change vs. Algeniux	-	-	0.9999 (NS)	0.9999 (NS)
	Cavex Color Change vs. Zelgan	-	-	0.0191(S)	0.0002 (S)
	Algeniux vs. Zelgan	-	-	0.0157 (S)	0.0005 (S)
CD	Cavex Color Change vs. Algeniux	-	-	0.9999 (NS)	0.9999 (NS)
	Cavex Color Change vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
	Algeniux vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
BC	Cavex Color Change vs. Algeniux	-	-	0.9999 (NS)	0.9999 (NS)
	Cavex Color Change vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
	Algeniux vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
BD	Cavex Color Change vs. Algeniux	-	-	0.9999 (NS)	0.9999 (NS)
	Cavex Color Change vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
	Algeniux vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
AC	Cavex Color Change vs. Algeniux	-	-	0.9999 (NS)	0.9999 (NS)
	Cavex Color Change vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)
	Algeniux vs. Zelgan	-	-	< 0.0001(HS)	< 0.0001(HS)

HS: Highly Significant; S: Significant; NS: Non-Significant

120 hours, the highest change was observed, i.e. 0.7074 ± 0.044. Similar to AB dimension, all remaining 5 dimensions (DA, CD, BC, BD and AC) showed similar pattern of mean % change in dimensional values.

Across different time points, the minimum % change was observed at immediate time point, which gradually increased at 30 minutes and at 48 hours, but at 120 hour the % change was maximum for all dimensions.

Among three groups, Cavex ColorChange material showed minimum % change across time points as compared to Algeniux and Zelgan groups, whereas Zelgan group showed maximum % change across all dimensions.

Table 2 contains Pairwise comparison between groups at different time points using Tukey's post-hoc test. There was a significant difference between the pairs of groups such as Zelgan with Cavex ColorChange and Zelgan with Algeniux ($p < 0.0001$) for all the dimensions at 48 and 120 hours. The difference between Cavex ColorChange with Algeniux group showed statistically insignificant difference as indicated by p-values > 0.05.

Table 3 represents Pairwise comparison across time points for various groups using Tukey's post-test.

All the paired differences were statistically insignificant ($p > 0.05$) for Algeniux and Cavex ColorChange group. But for Zelgan group, the difference between all the pairs of time points were statistically significant ($p < 0.05$), except for the pair immediate vs. 30 minutes. These results suggest that Zelgan material showed significant changes after 30 min for all the dimensions.

4. Discussion

An accurate cast is the most important pre requisite in fabrication and fitting of a dental prosthesis.[1] The accuracy of the cast is largely dependent on the dimensional stability of impression material. A precise, undistorted impression is, therefore, necessary to yield a cast to achieve a properly fitting prosthesis.[4]

Alginates, because of its numerous advantages like hydrophilicity, ease of use, pleasant taste and odour, non-staining ability, non-toxicity, good surface detail

Table 3: Pairwise comparison across time points for various groups using Tukey's post-test

Dimensions	Comparisons	Simple main effect (P-value) Groups		
		CavexColour Change	Algeniux	Zelgan
AB	Immediate vs. 30 minutes	-	0.9999 (NS)	0.9999 (NS)
	Immediate vs. 48 hour	-	0.3428 (NS)	<0.0001 (HS)
	Immediate vs. 120 hour	-	0.0500 (NS)	<0.0001 (HS)
DA	Immediate vs. 30 minutes	-	-	0.9999 (NS)
	Immediate vs. 48 hour	-	-	0.0248 (S)
	Immediate vs. 120 hour	-	-	0.0004 (S)
CD	Immediate vs. 30 minutes	-	-	<0.9847 (NS)
	Immediate vs. 48 hour	-	-	<0.0001 (HS)
	Immediate vs. 120 hour	-	-	<0.0001 (HS)
BC	Immediate vs. 30 minutes	-	-	0.9999 (NS)
	Immediate vs. 48 hour	-	-	<0.0001 (HS)
	Immediate vs. 120 hour	-	-	<0.0001 (HS)
BD	Immediate vs. 30 minutes	-	-	0.9999 (NS)
	Immediate vs. 48 hour	-	-	<0.0001 (HS)
	Immediate vs. 120 hour	-	-	<0.0001 (HS)
AC	Immediate vs. 30 minutes	-	-	0.9999 (NS)
	Immediate vs. 48 hour	-	-	<0.0001 (HS)
	Immediate vs. 120 hour	-	-	<0.0001 (HS)

HS: Highly Significant, S: Significant; NS: Non Significant

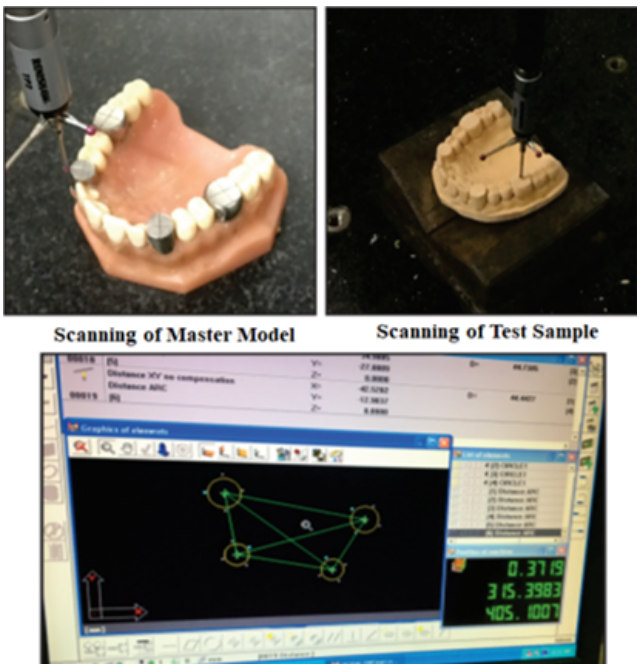

Figure 5: Measurements made using CMM (Coordinate measuring machine)

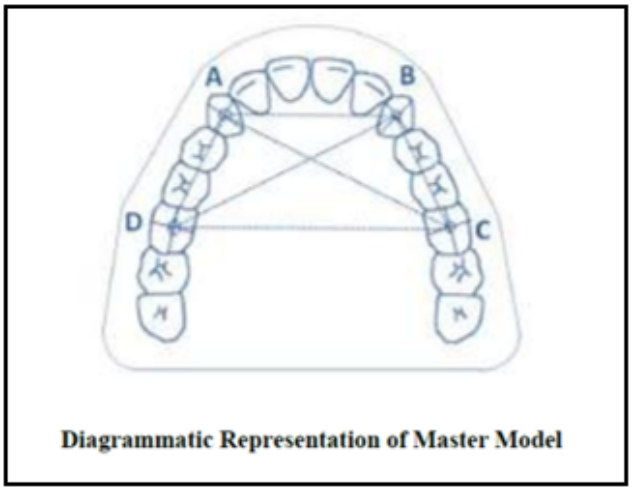

Figure 6: Diagrammatic representation of master model

reproduction, acceptable accuracy and feasibility still remains the most popular impression material worldwide.[3]

However, one major drawback of alginate impression materials is its tendency to distort over time.[10] Alginate being a hydrocolloid, almost 80% of its gel volume is occupied by water. If the water content of the set gel changes, the material will shrink or expand, affecting its

dimensional stability. The gel may lose water by evaporation from its surface, or by syneresis (exudation of fluid onto the surface). These properties cause shrinkage of the alginate gel. On the other hand, in presence of moisture the gel absorbs water resulting in expansion.[11] This expansion or contraction of alginate impression material will result in inaccurate casts and in turn a poorly fitting prosthesis.

Dimensional stability is also influenced by factors like manipulation of the material, water/powder ratio, type of tray, amount of space between the tray and tissues, temperature of water, disinfection treatments etc.[1,4]

Various studies have reported that with storage times of more than ten minutes, alginate begins to distort; and after one to three hours (depending on the product and storage conditions) it cannot be used for many clinical situations, especially fixed prosthodontics such as crowns and bridges.[12–14]

Recently, the manufacturers have developed a newer generation of alginates claiming to have a dimensional stability for up to 120 hours or 5 days. These are called 'extended pour' or '100-hour alginates'.

Despite the manufacturers' claims of producing accurate casts over time, the previous studies on extended pour alginates provided mixed results.[7,15–17] Also, there is scarcity of data on the locally available brands of extended pour alginates. Hence, the present study was designed to evaluate and compare the dimensional accuracy of casts obtained from two extended pour alginates (Cavex ColorChange and Algeniux) and a conventional alginate (Zelgan) at extended storage periods.

The impressions were poured at four different time intervals; immediate, 30 minutes, 48 hours (2 days) and 120 hours (5 days). The immediate and 30-minute time intervals were decided on the basis of previous investigations showing casts produced from immediate pour technique to be most accurate[6,18] and the maximum storage period recommended for conventional alginates to be 30 minutes.[5,19] 48 and 120 hours' time points were taken to assess the influence of extended storage on dimensional accuracy of impression materials. In addition, specific to the materials used, manufacturers claim that Zelgan remains stable up to 48 hours and Algeniux and Cavex ColorChange upto 120 hours.

The impressions were stored according to manufacturer's instructions in a sealed plastic bag. The casts obtained were then compared for dimensional accuracy across time.

Our protocol involving the use of a dentate model with reference points was clinically more applicable than the use of the single die according to the American Dental Association (ADA) specification no. 1868. Though the measurement of a single die can be performed with greater accuracy, researchers have recognized that this standard may not be sufficient to account for changes occurring over larger surface area. Moreover, the test samples produced from ADA specification no. 18 die do not represent a clinically relevant shape and thus are not subjected to the same path of insertion strains that produce distortions in clinical impressions. Another limitation is that the prescribed measurements are recorded from a planar surface, ignoring the possibility of three-dimensional direction distortion. Considering these facts, an arch shaped model was designed to mimic the intra oral structures as well as the stress involved in the impression procedure.[16,20]

A coordinate measuring machine was used to measure the dimensions on the casts. Several researchers in the past have used coordinate measuring machines for measuring the dimensional accuracy of models as it provides an accuracy of up to 0.001mm. Due to its ease of working, precision, digital recording of data and ergonomic benefits, a coordinate measuring machine was preferred.[21–23]

There is no specification for the maximum allowable percentage of dimensional change for alginate impression materials. However, ADA specification no. 1980 enumerates the maximum allowable dimensional change for elastomeric impression materials to be 0.40 percent for polysulfides and 0.60 percent for silicones. For alginate impression materials, Skinner et al[24] suggested that a value of 0.1 percent was acceptable, while Morrant and Elphicle[25] considered dimensional changes of more than 0.27 percent to be clinically insignificant. Imbery et al[7] when comparing extended pour alginate with conventional alginate used 0.5 percent as the maximum allowable dimensional change. The same was followed in the present investigation where the percentage of dimensional changes greater than 0.5 was considered as clinically unacceptable.

Comparing the dimensional accuracy of casts yielded from three impression materials used across the four time intervals, statistically insignificant differences were observed between two extended pour alginates Cavex ColorChange and Algeniux. In contrast, Zelgan, the conventional alginate when compared with Cavex ColorChange and Algeniux differed significantly at 2nd and 5th day.

Furthermore, the percentage of dimensional change for casts obtained from Cavex Color Change and Algeniux was less than 0.5% at all time intervals for all the dimensions tested as opposed to the casts obtained from Zelgan where dimensional change had exceeded 0.5% in the 48 and 120 hour interval.

These above results suggested that the impressions made from Cavex ColorChange and Algeniux produced clinically acceptable casts even when the storage time was delayed up to 120 hours. In contrast, impressions made from Zelgan were clinically unacceptable at 48 hour and 120-hour time interval.

Similar results were observed by Walker et al[26] where both extended storage alginates, Kromopan 100 and Alginmax demonstrated minimal dimensional change

between the three storage times 30 minutes, 48 hours and 100 hours, whereas, the conventional alginate, Jeltrate Plus was most accurate for only 30 minutes. Imbery et al[7] revealed that Cavex ColorChange was dimensionally stable over a period of 5 days whereas the conventional alginate, Jeltrate Plus was stable only till day 2. The results of the study conducted by Rohanian et al[2] suggested that the 2 extended pour alginates, Hydrogum 5 and Alginoplast impressions could be poured after 120 and 72 hours of storage, respectively with no significant dimensional changes whereas impressions made with Tropicalgin, a conventional alginate, must be poured as soon as possible and their storage time should be less than 24 hour. Similar results were reported by H.O. Gumus[16] and Sayed ME et al.[27]

Amongst all the time intervals, casts obtained from the immediate pour group was most accurate for all three materials which was in agreement with maximum number of previous researches.[6]

Also, it was detected that the cast dimensions increased with storage time suggesting shrinkage of the impressions over time. As explained by Coleman et al,[13] shrinkage causes the body of the impression to be drawn towards the borders of the test tray where the material is locked into the perforations. Hence, casts of larger arch dimensions were obtained.

The difference in behavior of the three impression materials with regard to dimensional changes across five day period is multifactorial and material specific. These factors include syneresis, movement of free water via evaporation and imbibition, ratios of calcium to sodium and filler to polymer, molecular weight of alginic polymers and other proprietary constituents.[28–30]

The reason for enhanced stability in extended pour alginates can be explained by Fellows and Thomas[31] where Nuclear Magnetic Resonance (NMR) spectroscopy was used to investigate the environment of water molecules in the matrix of commercial dental alginates. They suggested that stability was more in materials with lower water/powder ratio. Considering this factor, it is to be noted that water powder ratio of extended pour alginates used in this study was lower than the conventional alginate. They also found the greatest dimensional stability for the alginate powders is associated with high filler: alginate ratio and a high Ca: Na ratio. Also, Anseth et al[32] demonstrated that maximum dimensional stability is achieved when the alginate matrix is saturated with bound water, with no free (extra) water. In other words, just enough water is used to maximize the bound water (stable) potential, with no excess (unbound) water in the interstitial spaces, nor shortage of water molecules to occupy all bound water sites. It is important to minimize unbound water (reduce w/p) to reduce continued polymerization and therefore contraction. This creates the most stable configuration for hydrocolloids.

When the entire spectrum of this study is analyzed, it becomes evident that the casts produced from extended pour alginates were dimensionally accurate and clinically acceptable even after delayed pouring of the impressions.

5. Limitations

1. The investigation should be performed not only at 24 C, which was a limitation of this study, but also at higher temperatures to mimic setting under intra oral conditions.
2. Another limitation is that the measurements were recorded from the planar surface ignoring the possibility of errors in three dimensional directions.

6. Conclusion

1. The results revealed that both the extended pour alginates Cavex ColorChange and Algeniux produced dimensionally accurate casts at all-time intervals while the conventional alginate, Zelgan was accurate only at immediate and 30 minute time interval when stored according to manufactures instructions.
2. It was also observed that, among the 4 time intervals investigated, most accurate casts were obtained when the impressions were poured immediately.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Author biography

Tazeen Raees, Clinician and Private Practitioner

Usha Radke, Professor

Saee Deshpande, Professor

Neelam Pande, Dean, HOD, Professor and Post Graduate Guide

Shachi Alsi, Post Graduate Student

Cite this article: Raees T, Radke U, Deshpande S, Pande N, Alsi S. Comparative evaluation of the dimensional accuracy of two commercially available extended pour alginates and a conventional alginate impression material at various time intervals – An in vitro study. *IP Ann Prosthodont Restor Dent* 2024;10(1):38-46.