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## Original Research

### Effect of repeat pour on surface detail reproduction of three duplicating materials: A Comparative study

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#### ABSTRACT:

**Aim:** To evaluate and compare surface detail reproduction of three commonly available duplicating materials. **Material And Method:** In total twenty impressions were made of irreversible hydrocolloid (alginate), reversible hydrocolloid (agar) and Elastomers –Polyvinyl siloxane( putty and light consistency) and were poured immediately(1<sup>st</sup> pour) and same impression was repoured after 30 min(2<sup>nd</sup> pour).Surface detail reproduction of materials were evaluated using comparater. **Results:** Surface detail reproduction of irreversible hydrocolloid, reversible hydrocolloid and elastomers showed no significant difference when repoured immediately, but when re poured after 30 min results were significant between elastomers and irreversible hydrocolloid. **Conclusion:** irreversible hydrocolloids (alginate) when repoured after 30 minutes showed maximum loss of surface detail reproduction as compared to reversible hydrocolloid and Elastomers.

**Keywords:** Surface detail reproduction, irreversible hydrocolloid, reversible hydrocolloid, elastomers.

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#### INTRODUCTION

Making an impression represents a crucial step in processing and fitting dental prostheses. For this reason, the impression quality is decisive for the final fitting accuracy, and consequently, for the success of the restoration. Most common duplicating materials are reversible hydrocolloids. Earlier impressions were made using hydrocolloid impression materials, like reversible hydrocolloids (agar) and irreversible hydrocolloids (alginate). Agar duplicating materials are reversible and have adequate strength and elastic properties to make duplication of minor undercuts possible. <sup>[1]</sup> Irreversible hydrocolloid (alginate) is the impression material used most commonly in making dental casts for diagnosis, treatment, and fabrication of prostheses. Often, the cast is the direct link between the clinical phase of treatment and the technical laboratory procedures. Therefore, casts that accurately reproduce the necessary oral structures contribute significantly to the ultimate success of the prosthesis. Although irreversible hydrocolloid (alginate) impression materials are used extensively, casts poured in impressions made from these materials often have poor surfaces. <sup>[2, 3]</sup> One of the

major factors that have been taken into consideration in this study was that three commonly available and frequently used duplicating materials in dental practice were compared after repeat pouring simultaneously.<sup>[4]</sup> Acc to background less light was thrown on this aspect of simultaneous comparison. Moreover surface detail reproduction was evaluated after duplication. So considering all these facts in the present study an attempt was made to enlighten the most suitable material for duplication which reproduces maximum surface detail.

#### METHOD

The experimental design included four groups depending upon duplicating material used with 10 samples per group. Each of the group was subdivided into two subgroups depending upon time of pour of the impression .i.e poured immediately (1<sup>st</sup> pour) and repeat poured after 30 minutes (2<sup>nd</sup> pour) [Table 1].The duplicating materials used were irreversible hydrocolloid-Marieflex, reversible hydrocolloid- Castogel , elastomer- Affinis putty and Affinis light (fig.1) [Table 2]. Custom made stainless steel metal mould was fabricated according to ADA

specification 19 consisted of: A steel test blocks containing engraved lines of 25, 50 and 75 micrometer width, A metal ring for holding impression material (fig.2). Prior to impression making metal ring was fitted on the test block containing engraved lines in mould. Filling of metal ring: In case of Irreversible hydrocolloid (alginate)-appropriate proportion of powder and liquid was taken in a bowl and with help of curved stiff metal spatula uniform mix was obtained of alginate and metal ring was filled placed on test block. Autoduplicator was used for liquefaction of reversible hydrocolloid (agar) and then material was poured into the ring that was placed on the engraved test block in case reversible hydrocolloid (agar).For elastomer-Polyvinyl siloxane (putty consistency): Equal scoop of base and catalyst putty is kneaded with finger until uniform color was obtained and metal ring was filled and for light consistency equal length of base and accelerator paste was laid side by side without touching the mixing pad and uniform mix was obtained and filling of metal ring was carried out. Flat metal plate was placed over the ring containing impression materials to compress and expel the excess material out of the ring and materials were allowed to set.

#### POURING OF IMPRESSIONS

Ist pour (immediately): excess moisture was removed by gently compressing air over impression surface. Impression was poured immediately. After final set, impression was gently separated from the mould. 2<sup>nd</sup> pour (repouring after 30 minutes): again same impression was poured if it has not distorted and one more samples were retrieved out of it. All the fourty samples were retrieved for evaluation of surface detail reproduction (fig.3).



Fig.1

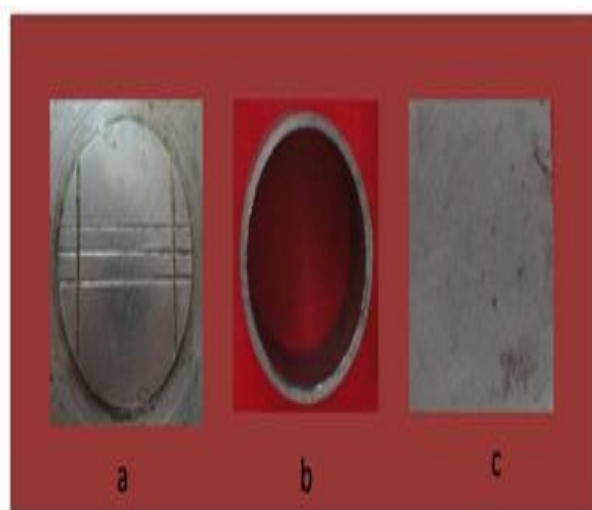


Fig.2

**Testing samples for evaluation of surface detail reproduction:** Testing of one sample of was carried out in following manner: Samples were measured by evaluating the extent of reproduction of lines on them. Finest line i.e. 25 micrometer wide line was taken as the criteria line. Each line was evaluated by using a custom made instrument “comparator”(Continental Instruments, Ambala Cantt, India) (fig.4) containing a **X10** magnification lens and scale marking.

**Each line was evaluated by following criteria:**  
**Score 1-** Continuous well defined sharp line was reproduced ( $25\mu\text{m}$ ), **Score 2-** Continuous line with loss of sharpness ( $\leq 25\mu\text{m}$ ), **Score 3-** Break in continuity of line ( $\leq 25\mu\text{m}$ ), **Score 4-** No line reproduced, **Score 5 -** Continuous well defined sharp line was reproduced ( $50\mu\text{m}$ ), **Score 6-** Continuous line with loss of sharpness ( $\leq 50\mu\text{m}$ ), **Score 7-** Break in continuity of line ( $\leq 50\mu\text{m}$ ), **Score 8-** Continuous well defined sharp line was reproduced ( $75\mu\text{m}$ ), **Score 9-**Continuous line with loss of sharpness ( $\leq 75\mu\text{m}$ ), **Score 10-**Break in continuity of line ( $\leq 75\mu\text{m}$ ).

#### RESULTS AND OBSERVATION

**Evaluation of surface detail reproduction:** The mean surface detail reproduction of irreversible hydrocolloid (alginate), reversible hydrocolloid (agar), Polyvinyl siloxane (putty and light consistency when poured immediately were 2.00, 1.40, 1.20 and 1.20when poured after 30 minutes means were 2.60, 2.00, 1.60 and 1.60 respectively [Table 3].Results were significant when the irreversible hydrocolloid was compared with Polyvinyl siloxane putty and light consistency pouring after 30 minutes. However non-significant differences were found, while comparing the irreversible hydrocolloid (alginate) and reversible hydrocolloid(agar).

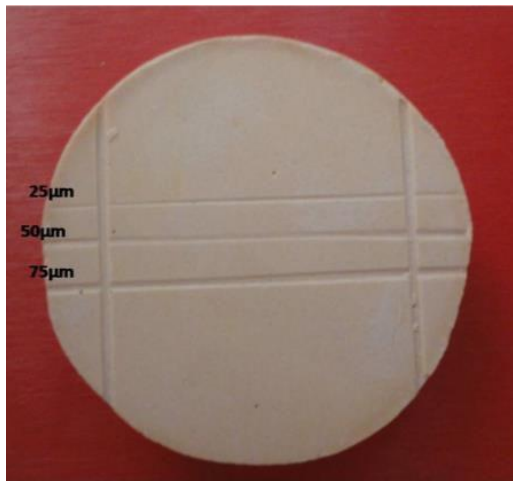


Fig.3



Fig.5

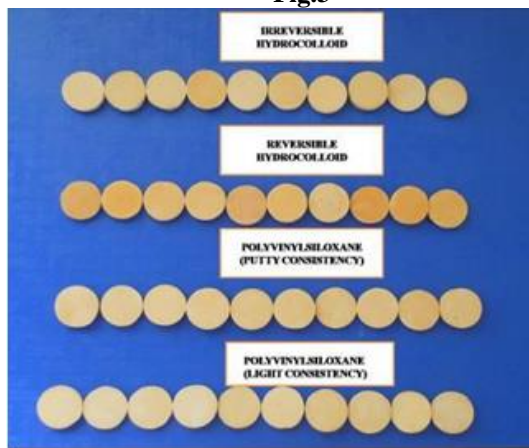


Fig.4



Fig. 6

Table.1: Distribution of samples

Subgroups (time of pour)	GROUPS (duplicating material used)				
	A (irreversible hydrocolloid)	B (reversible hydrocolloid)	C (Polyvinyl siloxane-putty)	D (polyvinyl siloxane-light)	
a (1 <sup>st</sup> pour) Immediately	5	5	5	5	20
b (2 <sup>nd</sup> pour) after 30 min	5	5	5	5	20
Total no.of samples persubgroup	10	10	10	10	
					<b>Grand total40</b>

Table.2: Duplicating materials

S.NO	Brand name	Material	Manufacturer
1.	Marieflex	Irreversible hydrocolloid	Septodont healthcare, India Pvt limited
2.	Castogel	Reversible hydrocolloid	Bego, Germany
3(i)	Affinis putty	Polyvinyl siloxane	ColteneWhaledent, Switzerland
3(ii)	Affinis light	Polyvinyl siloxane	Coltene Whaledent,Switzerland

Table.3.Group wise descriptive statistics

Groups	Sub Group (N=5)	MEAN	SD	Min.	Max.
	Aa	2.00	.707	1	3

<b>A</b>	Ab	2.60	.548	2	3
	Ba	1.40	.548	1	2
<b>B</b>	Bb	2.00	.707	1	3
	Ca	1.20	.447	1	2
<b>C</b>	Cb	1.60	.548	1	2
	Da	1.20	.447	1	2
<b>D</b>	Db	1.60	.548	1	2

## DISCUSSION

The most important characteristics of any dental duplicating material should include high accuracy, exact surface detail reproduction and controllable dimensional changes. A comparison of surface detail reproduction of various duplicating materials was evaluated in this study. For determining surface detail reproduction stainless steel compatibility test block from the ADA specification No.19 for impression material was used as the master mould. Similar test block was used in a study another study.<sup>[5]</sup> In another study reproducibility of impression material by using a stainless steel mould with engraved lines .25µm wide line was taken as criteria line. Custom made “comparator” was used for evaluating surface detail reproduction. In this ×10 magnification lens was used. Light source was also used for proper visualization of samples. Three duplicating materials used in this study were irreversible hydrocolloid (Alginate), reversible hydrocolloid (Agar), Elastomers-Polyvinylsiloxane (putty consistency) and Polyvinylsiloxane (light consistency). According to surface detail reproduction test, results indicated all the four duplicating materials when poured immediately (1<sup>st</sup> pour) had fine surface detail reproduction ability. Loss of surface detail may be due to syneresis and imbibitions which is usually seen after 30 min of impression making. Although when assessed after 30 min (2<sup>nd</sup> pour) irreversible hydrocolloid showed significant loss of surface detail reproduction as compared to reversible hydrocolloid and elastomers due to syneresis property which is evident in case of irreversible hydrocolloid (alginate). Factors which influence changes in irreversible hydrocolloid (alginate) impressions are syneresis, imbibitions and proprietary constituents controlled by manufacturer.<sup>[6]</sup> In reversible hydrocolloid (loss of surface detail reproduction was their but not significant), as reported earlier reversible hydrocolloid show change due to high water content and intern syneresis may occur because of evaporation of water but on the other hand elastomers-polyvinylsiloxane (light and putty consistency) showed superior means for surface detail reproduction, the possible reason may be because of loss of volatile reaction products water and alcohol. Among the materials tested in this study, alginate is the most popular in dental clinics because of low cost and easy use. So it is recommended that alginate should be poured immediately as it showed maximum loss of surface detail reproduction. If cost factor is not of much concern then elastomers should be material of choice.

## LIMITATION OF STUDY

This was an invitro study, despite attempts to closely replicate testing under oral conditions and clinical use; these test impression materials may perform differently invivo. They may be affected by oral fluids such as blood and saliva.

## CONCLUSION

Irreversible hydrocolloids (alginate) when repoured after 30 minutes showed maximum loss of surface detail reproduction as compared to reversible hydrocolloid and elastomers.

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