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**ORIGINAL ARTICLE**

# Comparative Evaluation of Different Dental Impression Materials in Duplicating Master Casts: An in-vitro Study

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***ABSTRACT*:**
**Background:** Impression materials and appliances used in oral environments such as prostheses can be potential sources of infection transmission. Quality and precision efficacy of different impression materials vary depending upon the type of impression material. Hence; we planned the present study to assess the efficacy of precision of condensational silicone and polyether for duplicating master dies. **Materials & methods:** We planned the present study to assess and compare the efficacy of condensation silicon and polyether in duplicating master casts. We prepared an acrylic model of upper premolar tooth was prepared based on conventional shoulder type marginal preparation, supragingivally. It was followed by preparation of grooves on all the proximal and other remaining surfaces. Special tray was then made. Based on the type of impression materials; two special trays were made. One for condensation silicon while other one for polyether impression materials. Each casting from each of the master dies was placed on each of the test dies which were made from the same respective impression material. The marginal discrepancy was recorded in all the cases. All the results were recorded and analyzed by SPSS software. **Results:** We didn't observe any significant difference while comparing the mean overall discrepancy in the polyether group. While comparing the overall discrepancy in the condensation silicon group, significant results were obtained. **Conclusion:** Polyether impression materials were found to have higher accuracy in comparison to condensation silicon in duplicating master casts.
**Key words:** Condensation silicon, Impression material, Polyether.

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## INTRODUCTION

Impression materials and appliances used in oral environments such as prostheses can be potential sources of infection transmission. The delivery of contaminated items into the laboratory environment transmits the infection to dental prostheses and the equipments used for other patients. It also increases the danger of infection transmission to the personnel of laboratories. Washing dental impressions with water only partly cleanses the flora on dental impressions.[1-3]Although disinfection of impressions eliminates the microorganisms off their surface, dimensional changes can also take place due to chemical or physicochemical reactions between the material set and the disinfectant solutions.[4]Since all the steps in the process of fabricating a precise prosthesis must be performed with ample accuracy and as impressioning is among the most important stages of prosthesis fabrication, infection control procedure must be accomplished in such a way that the impression materials do not undergo dimensional changes.[5-8]

Hence; we planned the present study to assess the efficacy of precision of condensational silicone and polyether for duplicating master dies.

## MATERIALS & METHODS

We planned the present study in the department of prosthodontics and included comparative assessment of efficacy of condensation silicon and polyether in duplicating master casts.

### Ethical approval

We obtained the ethical clearance from institutional ethical committee and obtained written consent after explaining in detail the entire research protocol.

### Methodology

We prepared an acrylic model of upper premolar tooth was prepared based on conventional shoulder type marginal preparation, supragingivally. It was followed by preparation of grooves on all the proximal and other remaining surfaces. Special tray was then made. Based on the type of impression materials; two special trays were made. One for condensation silicon while other one for polyether impression materials. Special trays were prepared with three occlusal stops. Based on manufacturer's instructions, manipulations were carried out. Separation of the stone casts was done from the impression and was stored for final setting. Casting procedure was carried out in both the cases. Final metal casts were made and were polished for further examination. They were then placed on their respective particular master chart for adaptation. Transferring of the prepared acrylic models was done followed by observation under stereomicroscope. Each casting from each of the master dies was placed on each of the test dies which were made from the same respective impression material. The marginal discrepancy was recorded in all the cases. All the results were recorded and analyzed by SPSS software. Chi- square test was used for assessment

of level of significance. P- value of less than 0.05 was taken as significant.

## RESULTS

Table 1 shows the mean discrepancies observed in the present study. Mean discrepancy observed in duplicate die and model in the polyether group was found to be 36.25 and 35.14 respectively. We didn't observe any significant difference while comparing the mean overall discrepancy in the polyether group. While comparing the overall discrepancy in the condensation silicon group, significant results were obtained.

**Table 1:** Mean discrepancies

| Type of impression material | | Mean overall discrepancy | P- value |
|---|---|---|---|
| **Polyether** | Duplicate die | 36.25 | 0.25 |
| | Model | 35.14 | |
| **Condensation silicon** | Duplicate die | 38.81 | 0.02 |
| | Model | 34.71 | |

## DISCUSSION

In the present study, we observed significant results while comparing the overall discrepancy in the condensation silicon group in comparison to the polyether group. Ratnaweera PM et al evaluated the dimensional accuracy of several impression methods including agar alginate combined impression in vivo; the marginal accuracy of stone dies was determined using a new electroformed master crown technique. Cast cores with knife-edge and chamfer margins and electroformed master crowns were fabricated for 3 patients. Five impressions were taken of each preparation, using agar alginate combined impression and silicone impression materials. Dies were made after impression. The marginal fit of the master crown on each die was analyzed by four-way analysis of variance (ANOVA) and Tukey HSD test ($p<0.05$). The marginal fit of the master crown on the dies with chamfer margin was better than those with knife-edge margin for agar alginate combined impression. The shape of the margin did not affect the accuracy when silicone impression material was used. The results suggested that the agar alginate impression method is clinically acceptable for the chamfer margin, but shape of the margin may affect the dimensional accuracy of dies. The shape of the margin does not affect the accuracy of dies when silicone impression was used.[9] Kalantari MH et al investigated the dimensional changes of two condensation silicone impression materials, Speedex and Irasil, after immersion in 0.5% sodium hypochlorite. In this in-vitro study, two condensation silicone impression materials, Speedex and Irasil, were used on a prefabricated metal model having two dies, one with and the other without undercut. Each impression material was used to prepare 30 impressions; half of each group was immersed in 0.5% sodium hypochlorite for 20 min. The casts were prepared and a profile projector was used to measure the casts in terms of height and diameter of the die without undercut, distance between the two dies, die diameter below the undercut, and the height of the die above the undercut. The results were statistically analyzed using Student t-test. In Speedex group, an increase was detected in the height of die without undercut and the height of the die above the undercut, but other dimensions have decreased. No significant change was observed in dimensions of Speedex group except for the distance between the two dies and die height above the undercut. In Irasil group, the height of the die without undercut, the distance between the two dies and the height of the die above the undercut have increased; while decrease was observed in other dimensions. Compared with the original sample, no significant difference was observed in dimensions except for the height of the die above the undercut.[10] Kane LM et al evaluated the marginal and internal fit of milled Co-Cr copings produced by CAD/CAM with 2 different marginal preparation designs. Four master dies were developed from 2 ivorine central incisors and 2 ivorine maxillary molars, 1 of each prepared with a 0.8-mm chamfer and a 1.2-mm rounded shoulder. These 4 groups of teeth were replicated with polyvinyl siloxane and used as templates to fabricate epoxy dies (n=10) for each of the 4 groups; a total of 40 epoxy resin dies. Cobalt-chromium copings of standard thickness (0.4 mm) were fabricated for each die with CAD/CAM technology. Next, the working dies were scanned with a 5-axis laser scanner to produce a 3-dimensional model. A thin layer of low-viscosity polyvinyl siloxane material was placed inside each coping and seated on the die until the material set. Copings were removed from the dies, leaving the polyvinyl siloxane intact, and these silicone-coated dies were scanned. The software superimposed the 2 scans, and the marginal openings and internal fit were measured at multiple locations. The marginal opening was determined at 4 locations: mid-buccal (mB), mid-lingual (mL), mid-mesial (mM), and mid-distal (mD), and the mean of these 4 measurement locations was referred to as the group variable "edge." The internal occlusal adaptation was measured at the midpoint from buccal to lingual and mesial to distal locations and referred to as mid-occlusal (mO). Means and standard deviations for edge (marginal adaptation) and mO were calculated for each of the 4 groups. A 2-sample t test was performed to detect differences among groups. A regression analysis was done to evaluate the interaction between the variables mO and edge ($\alpha=.05$). Significantly smaller mean marginal openings ($P=.017$) were observed overall for the chamfer marginal design (anterior chamfer: 61 ±41 μm; posterior chamfer: 52 ±27 μm) compared with the shoulder design (anterior shoulder 103 ±49 μm, posterior shoulder 113 ±110 μm). The anterior chamfer had a statistically significant ($P=.055$) smaller mean marginal opening (61 ±41 μm) than the anterior shoulder (103 ±49 μm). No statistically significant differences ($P=.119$) were found between the posterior chamfer and posterior shoulder. The internal adaptation at the mO location was not significantly different among all 4 groups ($P>.05$). However, a regression analysis demonstrated a strong correlation ($R=.842$; $P<.001$) between the occlusal seat (mO) and marginal opening, with the smaller mean marginal opening of the chamfer design coinciding with the smaller occlusal seat values (61μm; mO: 182 μm)

anterior chamfer; (52 µm; mO: 172 µm) posterior chamfer versus (103 µm; mO: 235 µm) anterior shoulder; (113 µm; mO: 242 µm) posterior shoulder. The milled Co-Cr copings produced with a CAD/CAM system in this study demonstrated clinically acceptable marginal fit in the range of 52 to 113 µm before ceramic application.[11]

## CONCLUSION

Under the light of above results, we conclude that polyether impression materials were found to have higher accuracy in comparison to condensation silicon in duplicating master casts. However; future studies are recommended.

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