Surface Porosity of Stone Casts Resulting from Immersion of Addition Silicone Rubber Impressions in Disinfectant Solutions

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This study investigated the effects of immersion of addition silicone rubber impressions in disinfectant solutions on the surface porosity of the resulting stone casts. Five brands of type 2 and 3 addition silicone rubber impression materials and one brand of type 4 dental stone were used. Impressions of a master die designed to simulate an abutment tooth were immersed in disinfectant for 30 minutes. The disinfectants used were 2% glutaraldehyde solution and 0.55% ortho-phthalaldehyde solution. The surface porosities of stone casts obtained from two brands of impression materials immersed in disinfectant for 30 minutes were determined. Results suggest that impression materials immersed in disinfectant solutions need sufficient time before pouring into dental stone. *Int J Prosthodont 2014;27:567–569. doi: 10.11607/ijp.3967*

In dental practice, disinfection of impression materials is required in order to prevent the transmission of infectious diseases.[1] For this purpose, immersion of addition silicone rubber impressions in disinfectant solutions is recommended.[2] Although addition silicone rubber impressions have many advantages, some materials have been reported to release hydrogen gas as a byproduct,[2–5] and immersion in disinfectants may affect the release of hydrogen gas. The aim of this study was to examine the surface porosity of stone casts resulting from immersion of addition silicone rubber impressions in disinfectant solutions.

Materials and Methods

The materials listed in Table 1 were used in accordance with the instructions of the respective manufacturers. An automatic mixer (Super Rakuneru, GC) was used to mix the dental stone.

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Figure 1 shows a stainless steel master die and a perforated metal tray adjusted to an impression thickness of 5 mm. The master die had an 8-degree taper to the vertical axis and a 1-mm-wide shoulder at the margin. The distance from the occlusal surface to the shoulder was 5 mm. The diameter of the upper surface was 8.3 mm and that of the lower portion was 9.0 mm.

The tray overfilled with mixed impression material was seated on the master die, which was overlaid with the impression material. Two minutes and 30 seconds after the start of silicone rubber mixing, the assembly was placed in a water bath maintained at 35 ± 1°C for each respective manufacturer's recommended setting time. After removal from the water bath, the impression was taken from the master die and rinsed for 30 seconds under tap water.

After rinsing, the impressions were assigned to four groups: immediately poured stone (C0), storage in air for 30 minutes (C30), immersion in 2% glutaraldehyde solution for 30 minutes (GA30), and immersion in 0.55% ortho-phthalaldehyde solution for 30 minutes (PA30). After the two modes of immersion disinfection, the impressions were rinsed again for 30 seconds under tap water.

Stone was poured onto the surface of the impression with vibration. Three stone casts were prepared for each disinfection condition. The resulting stone casts were assessed for whether surface porosity was evident with the aid of a ×3.5 magnifying lens. Photographs of the stone casts were taken with a digital camera (Cybershot DSC-T900, Sony).

Table 1 Materials Used

Code	Brand name	Type	Pouring time (min)	Manufacturer	Lot no.
ASL	Aquasil Ultra LV	3	15	Dentsply Cauk	080813
ASM	Aquasil Ultra Monophase	2	15	Dentsply Cauk	110823
EML	Examixfine Injection Type	3	10	GC	1202021
EMM	Examixfine Regular Type	2	10	GC	1108231
FUL	Fusion II Wash Type	3	10	GC	0808211
FUM	Fusion II Monophase Type	2	10	GC	1110131
I2L	Imprint II Light Body	3	30	3M ESPE	20081007
I2M	Imprint II Regular Body	2	30	3M ESPE	N387148
I3L	Imprint 3 Light Body	3	30	3M ESPE	360774
I3M	Imprint 3 Monophase	2	30	3M ESPE	308055
-	New Fujirock	4		GC	1006161
GA	Denthyde			Nippon Shika Yakuhin	ZAZ
PA	Disopa			Johnson & Johnson	196AJ

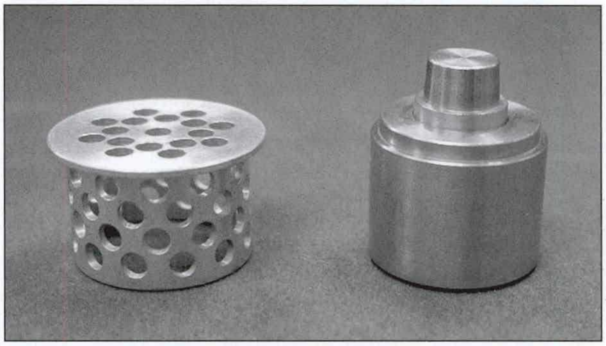

Fig 1 Master die *(right)* and tray *(left)*.

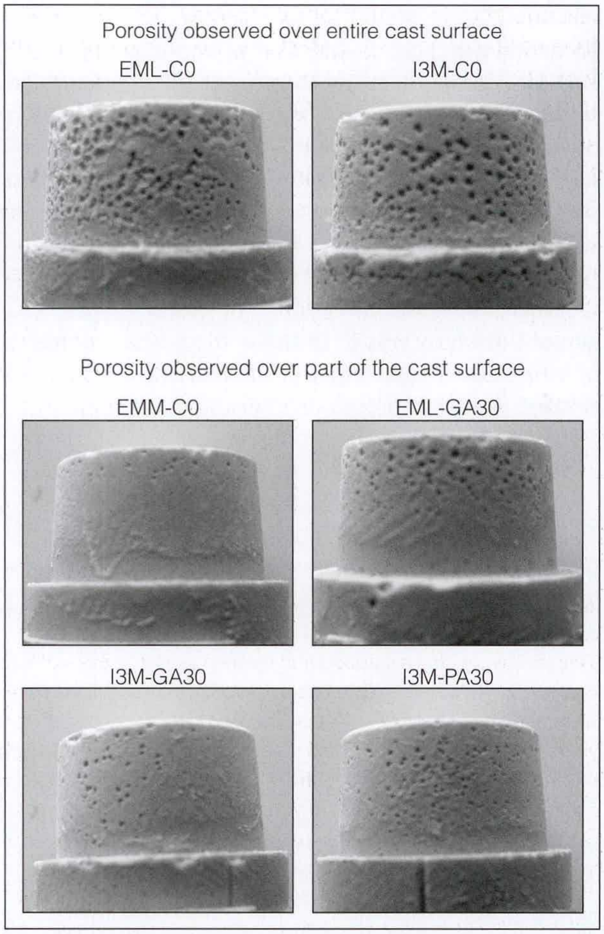

Fig 2 Stone casts studied for surface porosity. EMM = Examixfine Regular Type; C0 = immediately poured stone; EML = Examixfine Injection Type; GA30 = immersion in 2% glutaraldehyde solution for 30 min; I3M = Imprint 3 Monophase; PA30 = immersion in 0.55% ortho-phthalaldehyde solution for 30 min.

Table 2 Results of Surface Porosity for Stone Casts

Type	Impression	C0	C30	GA30	PA30
3	ASL	– – –	– – –	– – –	– – –
3	EML	++ ++ ++	– – –	+ + +	– – –
3	FUL	– – –	– – –	– – –	– – –
3	I2L	– – –	– – –	– – –	– – –
3	I3L	– – –	– – –	– – –	– – –
2	ASM	– – –	– – –	– – –	– – –
2	EMM	– + +	– – –	– – –	– – –
2	FUM	– – –	– – –	– – –	– – –
2	I2M	– – –	– – –	– – –	– – –
2	I3M	++ ++ ++	– – –	+ + +	+ + +

C0 = immediately poured stone; C30 = storage in air for 30 min; GA30 = immersion in 2% glutaraldehyde solution for 30 min; PA30 = immersion in 0.55% ortho-phthalaldehyde solution for 30 min; – = no surface porosity evident; + = porosity observed over part of the cast surface; ++ = porosity observed over entire cast surface.

The temperature of both the disinfectant and the water used was 23 ± 1°C. The entire experiment was conducted at a room temperature of 23 ± 1°C and a relative humidity of 50% ± 10%.

Results

The results of surface porosity determination for the stone casts are shown in Table 2. The surface porosities were observed by Examixfine Injection Type (EMI), Examixfine Regular Type (EMM), and Imprint 3 Monophase (I3M). The corresponding photographs are shown in Fig 2.

Discussion

While addition silicone is based on addition polymerization between polydivinyl siloxane and polymethyl hydrosiloxane, the residual polymethyl hydrosiloxane in materials can lead to a secondary reaction, either with itself or with moisture, to produce hydrogen gas.[2] Therefore, it is recommended that addition silicone should be left for 30 minutes before pouring into dental stone.[5] In this study, no surface porosity was observed under C30 conditions for any of the addition silicone products. Some products showed no surface porosity even under C0 conditions. However, EMI and I3M impressions immersed in disinfectant for 30 minutes showed some surface porosity. Therefore, the disinfectant solutions might have increased the release of hydrogen gas or interfered with the activity of hydrogen gas scavengers.

Conclusions

It may be necessary to allow sufficient time before pouring impression materials immersed in disinfectant solutions into dental stone dies.

Acknowledgments

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Literature Abstract

Amalgam or composite fillings—Which material lasts longer?

This review article was abstracted from an article found in the Cochrane Database Systemic Review 2014. Its objective was to investigate the failure rate of direct composite acrylic resin fillings versus amalgam fillings for permanent posterior teeth. Seven studies were selected, out of which data from only two parallel studies were included in the meta-analysis. A total of 871 participants, 6 to 12 years old, provided data, which was recorded for between 5 and 7 years. Most restorations in these studies were placed with the use of a rubber dam. It was found that the failure rate for amalgam was 7.5% and 14.2% over the period of investigation. The risk ratio of failure for composite compared to amalgam was 1.89 with 95% confidence interval (CI) of 1.52 to 2.35, leading to the inference that composites failed twice as often as amalgams. The primary mode of failure was attributed to caries, rather than fracture. However, there was a high risk of bias for the selected studies, and the lack of records regarding baseline caries experience in the participants. The author advised that if this data were to be applied clinically, one could expect replacement of composite restorations twice as often relative to amalgam. In conclusion, there is low-quality evidence to propose that composites may lead to increased failure rates and increased risk of secondary caries as compared to amalgam.

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