Effects of an Immersion Disinfectant and a Surface Disinfectant on Three Elastomeric Impression Materials

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Abstract
The purpose of this study was to evaluate compatibility between commonly used elastomeric dental impression materials and two disinfectants (Biosurf surface disinfectant, and Biomers immersion disinfectant, Micrylium Laboratories, Toronto, Canada).

Three impression materials (Express® 3M, Aquasil® Caulk-Dentsply, and Take-1® KERR-Sybron SDS) of high and low viscosities were tested in using ANSI/ADA Specification Test #19 for dental elastomeric impression materials. The low viscosity material was applied on to the die surface followed by the high viscosity (simulating clinical use). Physical properties such as surface detail reproduction and dimensional stability when the impression samples were exposed for the manufacturer's recommended time (Treatment Group), and when die-matched samples were immersed in deionized water for the same time (Controls) were measured. Sixteen control and 16 treatment specimens per material per disinfectant comprised the sample for the surface detail reproduction and for the dimensional stability tests. The 25 micron line was studied and given a score from 1(line completely reproduced with perfect edge detail) through 4 (line not completely reproduced) for detail reproduction, while the length of the 25 micron-wide line was measured after 24 hours using ImageTool© UTHSCSA-DS Software and a stage graticule as measurement standard. Two-way repeated measures ANOVA was used for test if disinfectants adversely affected impressions. Both impression material ($p < 0.001$) and disinfectant ($p < 0.001$) had significant effects on surface detail reproduction, but only impression material ($p < 0.001$) had a significant effect on dimensional stability. this study, the Biomers and Biosurf were found compatible with the three tested elastomeric dental impression materials when applied for the 5 minute disinfection time.

Purpose
To evaluate material compatibility (a. surface detail reproduction and b. dimensional stability) of three commonly used elastomeric dental impression materials (high and low viscosity) — Express® (3M); Aquasil® (Caulk-Dentsply); and Take-1® (KERR-Sybron SDS) with two disinfectants— Biosurf surface disinfectant and Biomers immersion disinfectant (Micrylium Laboratories)

Background
Dental impression materials need to be washed and disinfected immediately after making to control transfer of infectious materials from saliva and blood to casts and to dental healthcare workers.[1, 2, 3, 4] The ADA has recommended that impressions made be decontaminated.[5, 6, 7, 8] There are many commonly used disinfectants in dentistry.[9] Studies have shown that bacterial and viral contaminants can be effectively controlled by disinfection.[10, 11, 12] Disinfection process may sometimes affect material properties of impression materials.[13, 14] The Council on Dental Materials and Devices has methods for testing surface detail and dimensional stability of materials, and the same can be applied when disinfectants are used on elastomeric impression materials.[15]

Methods
ANSI/ADA specification # 19 for elastomeric impression materials and 4 ANSI/ADA spec. 18 & 19 dies were used in this evaluation. Very special die separator was applied on to the surface of the dies between each impression. The light body material was initially applied on the lines followed by the heavy body material. All impressions were made and allowed to polymerize at 35± 1oC to replicate the temperature in the mouth (set in water under a 1 Kilogram weight). The impression material remained in the bath three minutes longer than the manufacturer recommended time for setting. The treatment samples were immersed in their respective chemical germicide for 5 minutes (TB kill time or disinfection time) while the control were immersed in tap water for the same time. All treatment and control samples were die matched.

Surface Detail Reproduction

Once the impression material set, reproductions of the25 micron line on to elastomeric impressions was recorded. Outcomes recorded as– 1) Line reproduced comp letely; 2) Line not completely reproduced. This was used as a quality control measure. The entire length of the 25 micron line was observed at 10X and given an ordinal score as follows—

1. Well defined, sharp, continuous line
2. Continuous line but with some loss of sharpness
3. Significant deterioration of edge detail or loss of continuity of the line
4. Failure to reproduce the line

Figure 3 ***ANSI/ADA Specification Die Sets***

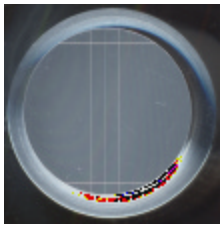

Figure 1 ***ANSI/ADA Specification 18/19 die.***

1= 50 micron width; 2 = 25 micron width; 3 = 75 micron

This interval level data were used for comparing the treatment and control groups and tested using a Student's t-test at an alpha of 0.05. The null hypothesis stated that "there was no difference between detail reproduction between the treatment and the control samples". If the treatment group's mean was significantly higher, then there was a deleterious effect being caused by the respective disinfectants. Sixteen impressions each per material per treatment group and control group were made.

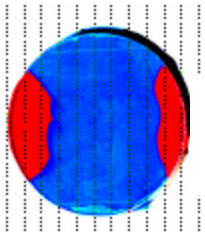

Figure 2 ***Elasomeric impression of the die showing the Light Body***

Impression material in Blue Color and Heavy Body in Red Color

Methods

Dimensional Stability

16 impressions each per treatment and control groups were used in this study and impressions made. The impression materials were air dried and placed on a glass slab with adequate amount of boric powder between the impression and the glass slab to facilitate the flow or creep without hindrance, for a period of 24 hours.

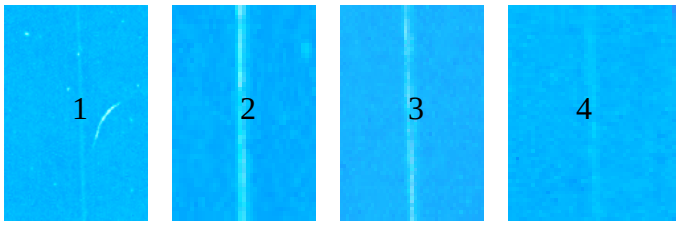

Figure 4 Criteria For Surface Detail Reproduction

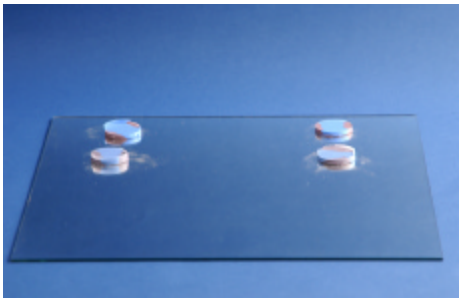

Figure 6 ***Impressions Placed on Boric Acid to StudyDimensional Stability***

Distance between the cross hatches on the block surface were measured after the impression was scanned on a flat-bed scanner with a standard (10 micron measure/calibrating slide) using Image-Tool Software (UTHSCSA Dental School, San Antonio, USA).

Differences in measurements between the groups were determined using a Two Way ANOVA. at an alpha of 0.05. If the dimensional changes were significantly greater in any group, then the inference would be that the particular treatment affected the process adversely. If difference no adverse effects of the there was no significant disinfectant was noted.

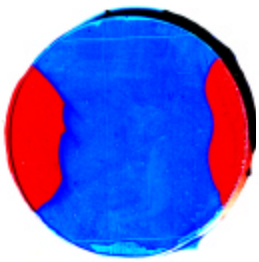

Figure 5 ***Impression Sample showing the intersection between the 50 micron line and the cross hatch***

Results and Discussion

		Dimensional Stability			
		Biosurf (N=96)		Biomers (N=96)	
		Mean	SE	Mean	SE
Take 1	Treatment	24.808	0.02	24.783	0.02
	Control	24.791	0.02	24.781	0.01
Aquasil	Treatment	24.809	0.02	24.820	0.01
	Control	24.803	0.02	24.830	0.02
Express	Treatment	24.716	0.03	24.738	0.02
	Control	24.773	0.03	24.758	0.02

		Surface Detail Reproduction			
		Biosurf (N=96)		Biomers (N=96)	
		Mean	SE	Mean	SE
Take 1	Treatment	2.56	0.13	2.47	0.09
	Control	2.31	0.12	2.31	0.08
Aquasil	Treatment	2.37	0.13	1.97	0.11
	Control	2.06	0.06	1.66	0.10
Express	Treatment	2.31	0.12	2.10	0.07
	Control	2.19	0.10	1.94	0.09

- The dies (n=4) had no significant effect on the outcomes of the ratings between the Treatment and Control samples with respect to Surface Detail Reproduction and Dimensional Stability ($p > 0.05$)
- There was a significant difference between the dies with respect to Surface Detail Reproduction ($p \leq 0.05$) Take-1 (KERR SDS) showed a significantly poorer detail reproduction ($p \leq 0.05$) than Aquasil (Caulk-Dentsply) and Express (3M) irrespective of the treatment
- There was no difference between both Biosurf and Biomers Treatment and Control groups with respect to both Surface Detail Reproduction and Dimensional Stability ($p > 0.05$)

Conclusions

In this study Biosurf (Surface Disinfectant) and Biomers had no deleterious effects on the Surface Detail Reproduction and Dimensional Stability properties of three commonly used elastomeric dental impression materials. Take 1 (KERR SDS) however showed poorer results with respect to Surface Detail Reproduction than the other impression materials tested irrespective of treatment with disinfectants

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