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RESEARCH AND EDUCATION

Effectiveness of a professional formula disinfectant for irreversible hydrocolloid

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In this study, the effectiveness of Professional Lysol (PL) disinfectant in both its spray and solution forms was evaluated as a surface disinfectant for irreversible hydrocolloid (IH) impressions. Sixteen impressions of a typodont were made with IH, immersed in a microbial broth, and then rinsed in running tap water. The impressions were then treated as follows: four were immersed in PL for 2.5 minutes; four were sprayed by PL and stored for 10 minutes; four were immersed in 2% glutaraldehyde for 10 minutes; four were untreated. Pretest plates showed an average of 421 colonies per plate (c/p). The glutaraldehyde group showed 0.00 c/p. The PL spray group showed 1.75 c/p. The PL immersion group showed 19.00 c/p and showed evidence of surface deterioration in the IH. The untreated group showed 426.25 c/p. (J PROSTHET DENT 1994;71:603-6.)

The increased public awareness of infectious diseases such as acquired immunodeficiency syndrome (AIDS) and hepatitis B have led to broad and sweeping changes in all health care delivery sectors. The ramifications of these changes are manifested in all phases of dentistry, from the barrier techniques used to treat patients to the barrier techniques used in the dental laboratory. The American Dental Association (ADA)[1] and the Centers for Disease Control (CDC)[2] have established guidelines that require all dental personnel to wear gloves, mask, and glasses while treating patients. Guidelines have also been established to limit cross contamination during dental laboratory procedures such as impression disinfection and sterilization.[1]

Samaranayake et al.[3] have shown that irreversible hydrocolloid impressions retain two to three times more bacteria than elastomeric impressions, with retention of bacteria on dentate impressions greater than on edentulous impressions.

Tobias et al.[4] reported that irreversible hydrocolloids that are preimpregnated with a disinfectant, such as didecyldimethyl ammonium chloride, reduce the overall quantity of bacteria on the impression; however, they showed weak antibacterial activity against *Candida albicans* and mixed bacterial samples and no activity against *Pseudomonas aeruginosa*.[4] Tyler et al.[5] showed that preimpregnated irreversible hydrocolloid materials were not virucidal. Preimpregnated irreversible hydrocolloids (with no subsequent chemical disinfection) did not demonstrate greater dimensional stability than conventional irreversible hydrocolloids immersed in diluted 2% glutaraldehyde and may therefore only serve to save disinfection time.[6]

Certain diluted 2% glutaraldehydes (2% glutaraldehyde with phenolic buffer 1:16 and/or 2% acid-potentiated glutaraldehyde diluted 1:4) will not significantly alter the dimensional accuracy of casts recovered from impressions immersed for 10 minutes.[7-9] The 2% acid-potentiated glutaraldehydes have been reported to improve the surface quality of casts recovered from irreversible hydrocolloid and elastomeric impression materials.[10,11] Bond et al.[12] showed that 2% glutaraldehyde with a phosphate-bicarbonate buffer and 2% glutaraldehyde with 7% phenol inactivated hepatitis B virus in a test tube after a 10-minute contact time. It has also been recommended that glutaraldehydes should not be used as a spray, because inhalation of the aldehyde vapor may be toxic to tissues.[13]

A 0.5% hypochlorite solution used as a 10-minute immersion[8] or spray with 10-minute storage[14] will not significantly alter the accuracy of the casts recovered from the impression. In contrast, other studies demonstrated statistically significant changes in dimensional stability when the impression was immersed in 0.5% hypochlorite[14] or 1% hypochlorite[11] for 10 minutes. Tullner et al.[15] suggested that the dimensional changes of the impression may depend on the brand of irreversible hydrocolloid and hypochlorite combination. Look et al.[16] demonstrated viral

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Table I. Analysis of variance for entire population (variable colonies by variable treatment)

Source	DF	Sum of squares	Mean squares	F Ratio	F Probability
Between groups	3	528403.5000	176134.5000	50.7160	0.0001
Within groups	12	41675.5000	3472.9583		
Total	15	570079.0000			

Table II. Data for treatment groups

Group	Count	Mean	Standard deviation	Standard error	95% Conf Int for Mean
1 NT	4	426.2500	117.7975	58.8987	238.8106 to 613.6894
2 Glut	4	.0000	.0000	.0000	.0000 to .0000
3 PL-I	4	19.0000	3.9158	1.9579	12.7692 to 25.2308
4 PL-S	4	1.7500	.5000	.2500	.9544 to 2.5456
Total	16	111.7500	194.9494	48.7373	7.8688 to 215.6312
Fixed effects model			58.9318	14.7330	79.6497 to 143.8503

Random effects model, estimate between component variance 43165.3854.
NT, No treatment; Glut, glutaraldehyde; PL-S, Professional Lysol spray; PL-I, Professional Lysol immersion solution.

Table III. Posttest colonies

Group	n	Mean	SD	Statistically significant subsets
Glut	4	0.00	0.00	Subset A
PL-S	4	1.75	0.50	Subset A
PL-I	4	19.00	3.95	Subset B
NT	4	426.25	117.80	Subset C

Key to abbreviations in footnote of Table II.

inactivation of the vesicular stomatitis virus (VSV virus) with a 0.5% hypochlorite solution by spray with 10 minute storage or a 10 minute immersion of irreversible hydrocolloid. Hepatitis B inactivation has also been demonstrated in a test tube, with a 10-minute contact time in a hypochlorite solution with 500 mg of free available chlorine per liter.[12] Other studies have demonstrated good bactericidal activity with a spray or immersion modality.[14, 17] Hypochlorite solutions, unfortunately, tend to corrode metal trays.

A 10-minute immersion in an iodophor solution inactivated the VSV virus[16] and did not alter the dimensional accuracy of casts recovered from irreversible hydrocolloids.[7, 9] An iodophor solution also demonstrated inactivation of the hepatitis B virus in a test tube, with a 10-minute contact time.[12] Kolstad et al.,[18] using an iodine concentrate diluted 1:212 with water, demonstrated bactericidal activity when the solution was used as a 5-minute immersion or a 2-second dip with 5-minute storage, but not as a spray. However, some evidence seems to indicate that iodine solutions will stain or adversely affect the resulting cast surface.[19]

A spray with 10-minute storage or immersion with a phenolic solution will not significantly alter the dimensional accuracy of casts recovered from irreversible hydrocolloids[7, 8, 20] and will achieve viral inactivation of the VSV virus.[16]

Christensen et al.[21] evaluated Professional Lysol spray (79% ethanol and 0.1% o-phenylphenol) and Professional Lysol liquid (quaternery ammonium compound) (National Laboratories Montvale, N.J.), in the presence of five test organisms (*P. aeruginosa, Salmonella choleraesuis, Staphylococcus aureus, Mycobacterium bovis*, and poliovirus type 1 [Mohoney strain]) and found consistently high antimicrobial activity across all five test organisms—both in the absence and presence of bioburden.[21] It was also concluded that, " . . . Lysol sprays, . . . met the criteria, regardless of the test method or contact time used."[21]

The objective of this study was to evaluate the antimicrobial properties of both Professional Lysol spray and Professional Lysol immersion solution on irreversible hydrocolloid impressions.

MATERIAL AND METHODS

Sixteen impressions of a typodont were made with an irreversible hydrocolloid impression material (Jeltrate Plus, L. D. Caulk Div., Dentsply Int., Milford, Penn.) mixed according to the manufacturer's instructions. When set, the impressions were removed and placed in a mixed bacterial solution made from saliva of known turbidity (2.5 KLETT units) for 30 seconds, then rinsed for 30 seconds under running tap water. With the use of a sterile pipette, 0.3 ml of nutrient broth was then placed into each individual tooth impression. Two standard sites were selected, one anterior and one posterior. The solution was agitated for 1 minute to ensure that the organisms were dislodged from

the surface of the impression material. After 1 minute the nutrient broth was removed in 0.1 milliliter samples with a sterile pipette and plated on a nutrient agar medium. This resulted in two samples for each tooth impression (0.1 milliliter was lost in the impression from the original 0.3 ml sample) and 4 samples (2 anterior and 2 posterior) for each impression/disinfection combination.

The impressions were then treated as follows:

1. Four were sprayed with Professional Lysol spray four times with a 10 minute storage time (PL-S).
2. Four were immersed in Professional Lysol immersion solution for 10 minutes (PL-I).
3. Four were immersed in 2% glutaraldehyde with a phenolic buffer (Sporicidin, Dentsply Int., York, Pa.) for 10 minutes (GLUT).
4. Four impressions were untreated (NT).

A second nutrient broth solution was then pipetted into the impression, removed, and plated as described (two sites per impression, two samples per site). All culture plates were incubated for 48 hours at 37° C and resultant colonies were counted.

RESULTS

Pretest plates showed an average of 421 colonies per plate with no difference between groups. After treatment, the glutaraldehyde group showed 0.00 colonies per plate, the Professional Lysol spray showed 1.75 colonies per plate, and the Professional Lysol immersion group showed 19.00 colonies per plate, with evidence of surface deterioration in the irreversible hydrocolloid. The control group, which received no treatment, showed 426.25 colonies per plate. A one-way ANOVA (Tables I and II) and Scheffe tests ($p < .01$) (Table III) showed the professional Lysol immersion group to be statistically different from the glutaraldehyde and Professional Lysol spray groups.

DISCUSSION

Professional Lysol spray is primarily an alcohol (79% ethanol, 0.1% o-phenylphenol) whereas Professional Lysol immersion solution is a quaternary ammonium compound. It is generally accepted that quaternary ammonium compounds have poor antibacterial activity (spore- and non-spore-forming bacteria) and poor antiviral activity, and the ADA Council on Dental Therapeutics has eliminated them from the list of acceptable agents.[22] Therefore, it was understandable to find that Professional Lysol immersion solution was less effective than Professional Lysol spray. In addition, during immersion in Professional Lysol solution, the impression began to deteriorate with bits of alginate separating into the broth, indicating probable adverse effects on the surface detail and dimensional stability of any casts recovered from the impression. The small difference between glutaraldehyde immersion and Professional Lysol spray may be the result of difficulty in ensuring uniform wetting of the impression with only four sprays.

Professional Lysol spray is easier to use and more time efficient, because it does not have to be premixed. As stated, glutaraldehydes have a greater potential for toxicity to tissues.[22] From a disinfection point of view, PL-S is a viable alternative to gluteraldehyde immersion solution. Further studies are now needed to determine whether surface detail, dimensional stability, or both are affected by the PL-S method.

CONCLUSION

This study demonstrated that Professional Lysol spray, with a 10-minute contact time, was an adequate surface disinfectant for irreversible hydrocolloid. Further studies are now needed to determine whether any of the physical properties of the irreversible hydrocolloid impression are altered by this procedure.

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