

Comparative evaluation of microbial counts on hand after using surgical and examination gloves

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Introduction

Gloving is recommended as a method of barrier protection for healthcare workers to reduce the risk of contamination during contact with body fluids, mucous membranes or the damaged skin of patients. Gloves when used properly reduce cross transmission of micro-organisms from healthcare workers' hands. Wearing gloves is associated with a marked reduction of bacterial contamination of hands. However gloves are overused and often misused leading to increased risk of infection to both dentist and patient. As a public health intervention, all dental health care workers are strictly informed by the Center for Disease Control and Prevention to use sterile surgical gloves as a routine in the practice of dentistry to prevent Hepatitis B virus, HIV and other common infectious diseases.^{1, 2,3,4,5,6}

ABSTRACT:

AIM: To compare the bacterial counts after treatment with examination gloves and surgical gloves.

MATERIALS AND METHODS: Pulpectomy procedure of approximately 45 minutes duration was performed with either examination or surgical gloves. Participants were selected randomly and divided in two groups of 10 each. Group I: ten procedures using examination gloves. Group II: ten procedures using surgical gloves. Microbial count (CFU) on tips of all fingers and thumb were compared after using examination gloves and surgical gloves. Samples were collected at 3 intervals: before washing hands (S1), after washing hands immediately before donning gloves (S2) and after removing gloves immediately before washing hands (S3). Samples were collected by placing the tips of all fingers and thumbs on the fresh blood agar plates. Plates were then streaked to facilitate counting the CFUs. Plates were then incubated at 37° C for 24 hours to allow microbial growth.

RESULTS: Number of CFU on each sample was counted. Data was analyzed using Mann Whitney U Test and Wilcoxon matched paired test. There was 90.19% reduction in microbial count after using surgical gloves whereas there was 0.18% increase in microbes on hands after using examination gloves.

CONCLUSION: Results concur that using examination gloves for operative procedures is hazardous for both clinician and the patient

Key words: Examination gloves, Hand contamination, Microbial counts, Surgical gloves.

Two types of gloves are commercially available in the market.^{7,8}

1. **The surgical gloves:** They are thicker and provide more protection. Used routinely for dental and surgical procedures. Act as a protective barrier to prevent possible transmission of diseases between healthcare professionals and patients during surgical procedures.
2. **Examination gloves:** They are thinner and provide less protection and mainly used for diagnostic procedures like during clinical examination. These gloves are used during procedures that do not require sterile conditions.

Examination gloves are thinner, more porous so use of examination gloves for any dental procedure other than examination and diagnostic is contraindicated. Still in today's scenario it is commonly seen that examination gloves are routinely used for operative and surgical procedures both in private clinic and in institutions. This practice increases the risk of infection for both dentist and patient. This study was carried out to shed light upon the hazards of such practices and may act as a reminder for the administrators and dental health workers to employ proper use of gloves.

Materials and methods:

Study was conducted at Dept of Pedodontics and Preventive Dentistry in Maratha Mandal's NGH Institute of Dental Sciences and Research Centre, Belgaum, Karnataka. Study protocol was approved by Institutional review board parents of the Patients willing for the study were recruited and informed written consent was taken. Procedure selected for the study was Pulpectomy with approx 45 min duration. Participants were selected randomly and divided in two groups of 10 each by alternate allocation.

Group I: Ten procedures using surgical gloves (Rakshak[®] latex examination gloves, Shivsagar Ind, Mumbai, India). **Group II:** ten procedures using examination gloves (Serjun[®] Disposable Surgical Rubber Gloves, Kurian Abraham Pvt Ltd, Nagercoil, India).

Microbial count (CFU) on tips of all fingers and thumb were compared after using examination gloves and surgical gloves after collection of samples at 3 intervals: S1: Before washing hands, S2: After

washing hands immediately before donning gloves, S3: After removing gloves immediately before washing hands.

Samples were collected by placing the tips of all fingers and thumbs on the fresh blood agar plates. Plates were then streaked to facilitate counting the CFUs and incubated at 37°C for 24 hours to allow microbial growth. (Fig. 1 & 2) Counting was done by a second examiner who was blind for the clinical procedure.

Results: Data was tabulated and analyzed using Mann Whitney U Test and Wilcoxon matched paired test.

Mean value for CFUs in surgical and examination gloves group at S1 for was surgical group 181.4 and for examination gloves it was 162.6. For S2 it was: surgical gloves group 24.9 and for examination gloves group it was 31.4. For S3 it was: surgical gloves group 17.8 and for examination gloves group it was 162.9 (0.0002) (Table 1)

Examination gloves showed statistically significant increase in microbial count as compared to surgical gloves after the procedure ($p = 0.0002$) (Table 2, Graph 1). Before washing hands (S1), the CFU count was high for both surgical and examination gloves groups. After hand washing (S2) the CFU count decreased for both surgical and examination gloves groups. However after using examination gloves (S3) the bacterial count on hands increased drastically while in surgical gloves group (S3) it remained low. After using examination gloves there was 418.79% increase in microbial count as compared to 28.51% in surgical gloves when S2 and S3 were compared. CFU count on hands increased by 0.18% after using examination gloves, while it decreased by 90.19% when S3 and S1 were compared. (Table 2, Graph 2)

Discussion

Results of this study have supported the view that use of examination gloves in operative procedures leads to high risk of transmission of micro-organisms due to more permeability of these gloves and thus is very dangerous. Many studies have been done in past towards same purpose.^{1,2,3,9} But most of these studies are in vitro. Clinical studies regarding safety of different gloves are lacking and this study may help to bridge this gap in literature and give a credible reference to the hazards of using examination gloves during

operative procedures. The primary purpose of the gloves is to provide a physical barrier to the transfer of microorganisms and other agents. They are fairly effective against organisms that are 10 microns or larger (e.g., bacteria), but there is little evidence that they effectively protect the wearer from viruses encountered in practice.¹⁰ Latex gloves have numerous porosities that are 3-15 microns in diameter. These porosities increase in size and number when the gloves are stretched and used. 10 micron voids are the smallest imperfections that can be detected by usual testing methods.¹¹ It is seen that besides their natural porosity, latex gloves frequently have manufacturing defects in the form of visible holes 50 microns or larger in diameter. These voids increase in size and number as the latex is worn or just exposed to atmospheric ozone.^{12,13} Results of current study are in line with the studies cited earlier and concur that using examination gloves is hazardous for both clinician and the patient.

Conclusion:

To prevent transmission of pathogens across dental operatory, surgical gloves should be used for all operative procedures. Examination gloves should

be restricted to clinical examination only. Any deviation from the established guidelines on use of gloves in dental setting may lead to spread of infection thus putting both dentist and patient at risk.

Clinical significance:

This study adds in the body of scientific knowledge about the hazards of using examination gloves for operative procedures. This clinical study clearly demonstrates that use of examination gloves for operative procedures leads to high hand contamination and thus increases the risk of transfer of pathogens across dental operatory.

Limitations of the study:

In the current study only one commercially available brand of both types of gloves was used. So variation in the various brands of surgical and examination gloves could not be established.

Conflict of interest: none

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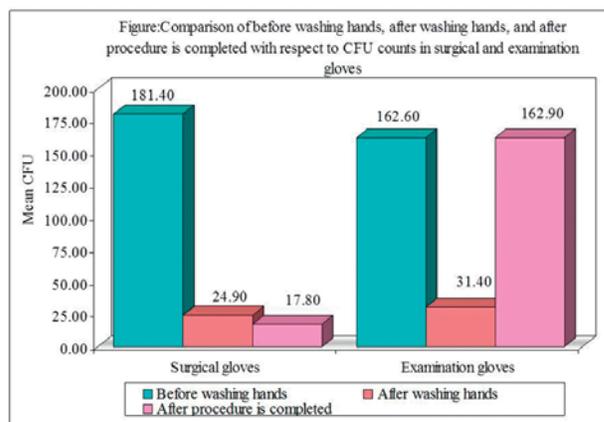
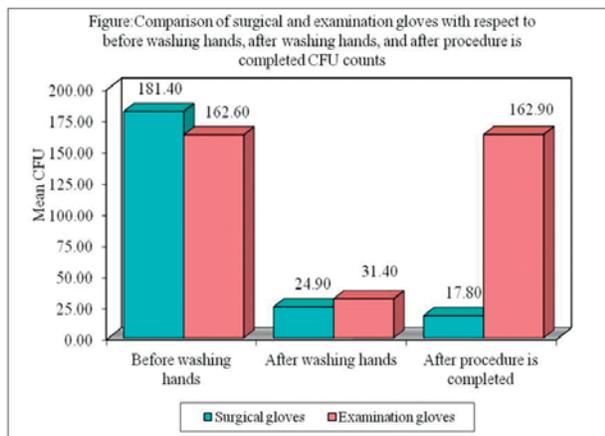
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TABLE 1: Mann Whitney U Test: to test if difference in two groups is statistically significant

Time points	Gloves	Mean	SD	Median	U-value	Z-value	p-value
Before washing hands	Surgical	181.40	70.08	200.0	42.00	-0.6047	0.5454
	Examination	162.60	82.52	135.0			
After washing hands	Surgical	24.90	40.10	15.0	42.00	-0.6047	0.5454
	Examination	31.40	32.34	24.0			
After procedure is completed	Surgical	17.80	13.68	12.5	0.00	-3.7796	0.0002
	Examination	162.90	57.88	139.0			
Before washing hands- after washing hands	Surgical	156.50	71.27	153.0	40.00	-0.7559	0.4497
	Examination	131.20	87.31	91.5			
Before washing hands - after procedure is completed	Surgical	163.60	68.81	169.5	8.00	-3.1749	0.0015
	Examination	-0.30	103.24	21.5			
After washing hands - after procedure is completed	Surgical	7.10	32.16	1.0	1.00	-3.7041	0.0002
	Examination	-131.50	79.73	-110.5			

TABLE 1: Within group comparison of CFU counts after using surgical and examination gloves by Wilcoxon matched pairs test:

Time points	Mean CFU		% of change		Z-value		P-value	
	surgical	examination	surgical	examination	surgical	examination	surgical	examination
s1	181.40	162.60	86.27	80.69	2.8031	2.8031	0.0051	0.0051
s2	24.90	31.40						
s1	181.40	162.60	90.19	-0.18	2.8032	0.2548	0.0052	0.7989
s3	17.80	162.90						
s2	24.90	31.40						
s2	24.90	31.40	28.51	418.7	0.5331	2.8031	0.5940	0.0050
s3	17.80	162.90						



Graph 1: diagrammatic representation of Mann Whitney U Test: to test if difference in two groups is statistically significant.

Graph 2: diagrammatic representation of within group comparison of CFU counts after using surgical and examination gloves by Wilcoxon matched pairs test.

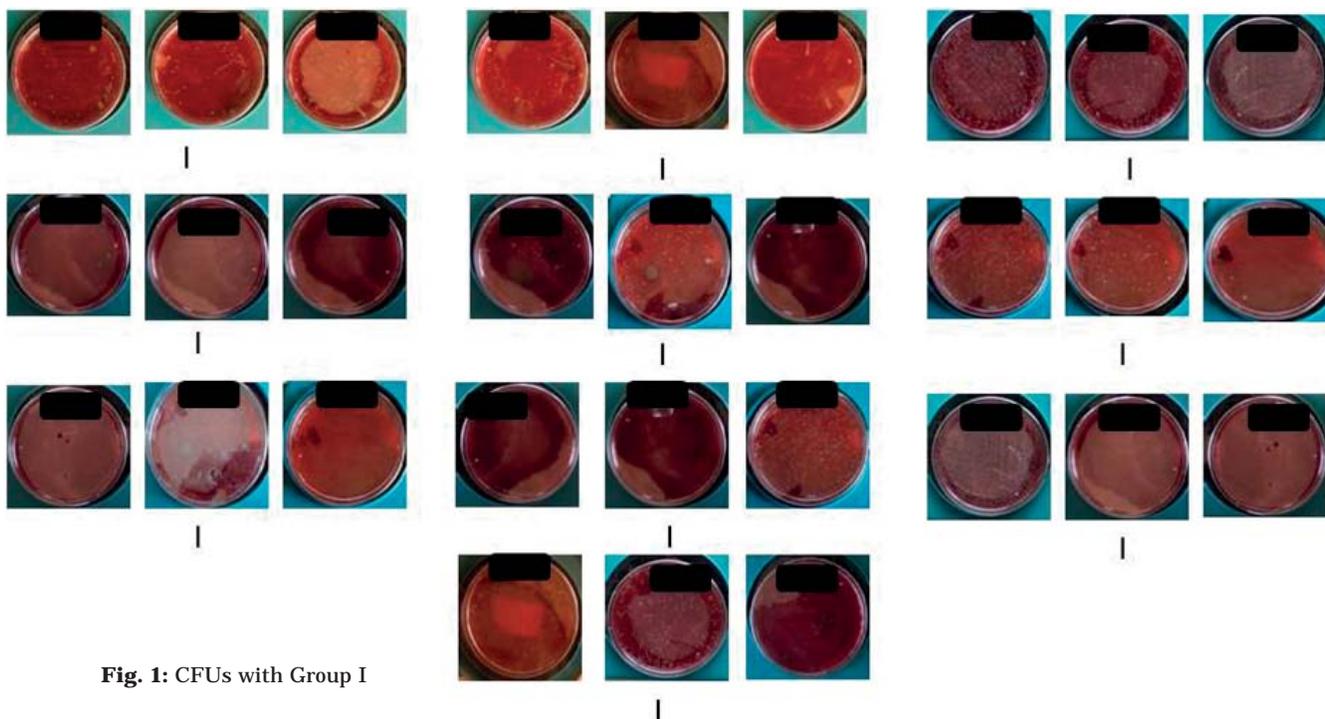


Fig. 1: CFUs with Group I

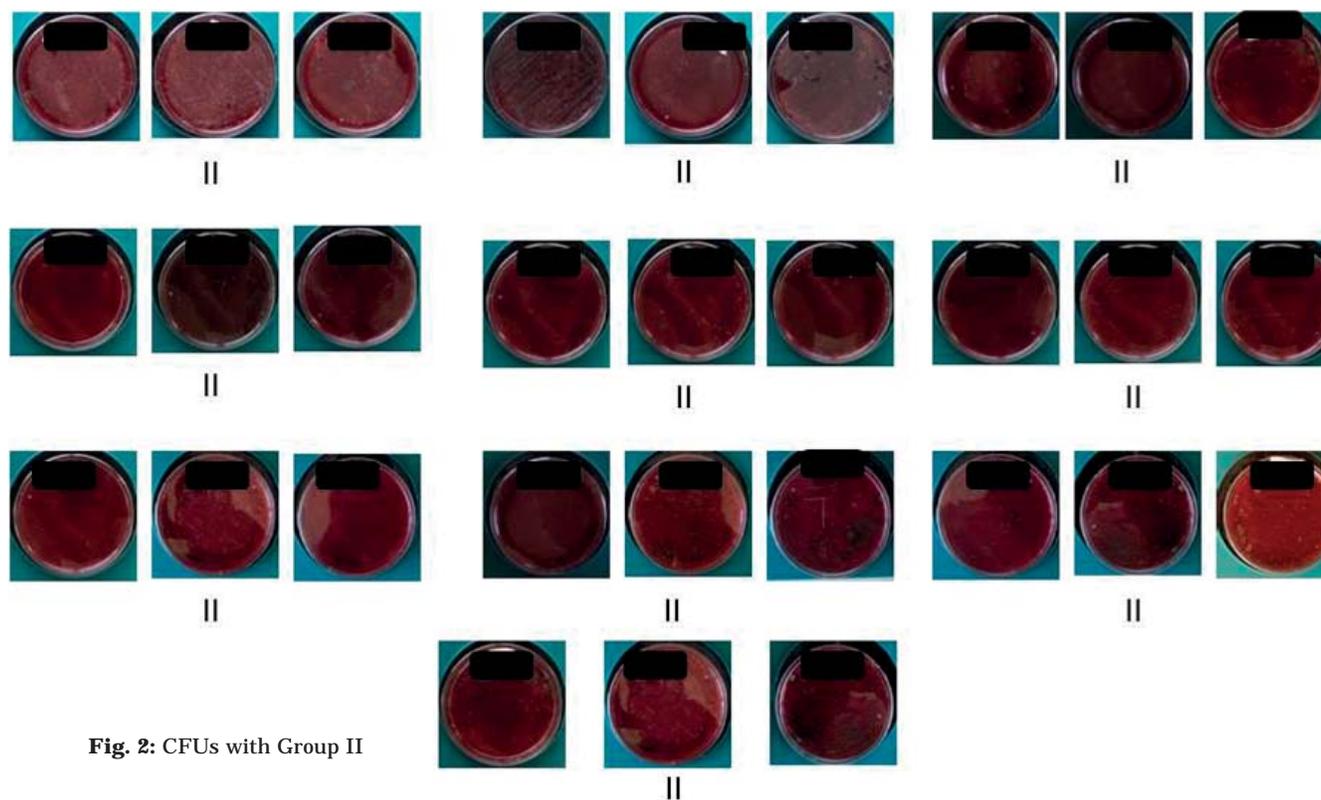


Fig. 2: CFUs with Group II

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