

Surgical Gloves: Puncture Holes and Bacteria (11/10)

Harnoss JC, Partecke LI, Heidecke CD, Hübner NO, Kramer A, Assadian O. Concentration of bacteria passing through puncture holes in surgical gloves. *Am J Infect Control* 2010;38:154–158.

The reasons for wearing gloves for surgery are to protect the surgical field from microorganisms on the surgeon's hands and protect the surgeon from microorganisms from patients. This study measured the concentration of bacteria passing through glove punctures during surgical procedures. Double-layered surgical gloves were worn during visceral surgeries over four months. The study included 128 outer gloves and 122 inner gloves from 20 septic laparotomies. To measure bacterial passage through punctures, intraoperative swabs were made, yielding microorganisms that were compared with microorganisms retrieved from the inner glove layer. Depending on the duration of glove wear, the microperforation rate of the outer layer averaged 15%. Approximately 82% of the perforations went unnoticed by the surgical team. Eighty-six percent of perforations occurred in the nondominant hand, with the index finger being the most frequently punctured location (36%). Bacterial passage from the surgical site through punctures was detected in 4.7% of the investigated gloves. **Depending on the duration of wear, surgical gloves develop microperforations not immediately recognized by staff.**



During surgery, such perforations allow passage of bacteria from the surgical site through the punctures. Possible strategies for preventing passage of bacteria include improving the gloves' barrier function by double gloving, strengthening of glove areas prone to punctures or strict glove changing every 90 minutes.

DECS Comment: Limited studies of the penetrability of different glove materials under conditions of use have been conducted in the dental environment. Consistent with observations in clinical medicine, leakage rates vary by glove material (e.g., latex, vinyl, and nitrile), duration of use, and type of procedure performed¹⁻⁶, as well as by manufacturer.⁷⁻⁹ The frequency of perforations in surgeon's gloves used during outpatient oral surgical procedures has been previously reported to range from 6% to 16%.¹⁰⁻¹³ The current study supports previous publications which have demonstrated that health-care personnel (HCP) and dental health-care personnel (DHCP) are frequently unaware of minute tears in gloves that occur during use.^{3,5,6,14} These studies determined that gloves developed defects in 30 minutes–3 hours, depending on type of glove and procedure, however investigators did not determine an optimal time for changing gloves during procedures.

In the present study, the authors discussed the possibility of wearing double gloves to prevent punctures and passage of bacteria. The Centers for Disease Control and Prevention (CDC) *Guidelines for Infection Control in Dental Health-Care Settings—2003* provide information on wearing two pairs of gloves during dental procedures. The CDC considered this an unresolved issue for dentistry because of the lack of evidence in preventing disease transmission.¹⁵ The CDC dental infection control guidelines state: "Although the effectiveness of wearing two pairs of gloves in preventing disease transmission has not been demonstrated, the majority of studies among HCP and DHCP have demonstrated a lower frequency of inner glove perforation and visible blood on the surgeon's hands when double gloves are worn."^{10-12,16-19} In one study evaluating double gloves during oral surgical and dental hygiene procedures, the perforation of outer latex gloves was greater during longer procedures (i.e., >45 minutes), with the highest rate (10%) of perforation occurring during oral surgery procedures.¹³ Based on these studies, double gloving might provide additional protection from occupational blood contact.²⁰ Double gloving does not appear to substantially reduce either manual dexterity or tactile sensitivity.²¹⁻²³ Additional protection might also be provided by specialty products (e.g., orthopedic surgical gloves and glove liners).^{24,}

References

1. Burke FJ, Wilson NH. The incidence of undiagnosed punctures in non-sterile gloves. *Br Dent J* 1990;168:67–71.
2. Nikawa H, Hamada T, Tamamoto M, Abekura H, Murata H. Perforation of dental gloves during prosthodontic treatments as assessed by the conductivity and water inflation tests. *Int J Prosthodont* 1996;9:362–366.
3. Otis LL, Cottone JA. Prevalence of perforations in disposable latex gloves during routine dental treatment. *J Am Dent Assoc* 1989;118:321–324.
4. Morgan DJ, Adams D. Permeability studies on protective gloves used in dental practice. *Br Dent J* 1989;166:11–13.
5. Albin MS, Bunegin L, Duke ES, Ritter RR, Page CP. Anatomy of a defective barrier: sequential glove leak detection in a surgical and dental environment. *Crit Care Med* 1992;20:170–184.
6. Merchant VA, Molinari JA, Pickett T. Microbial penetration of gloves following usage in routine dental procedures. *Am J Dent* 1992;5:95–96.
7. Pitten FA, Herdemann G, Kramer A. The integrity of latex gloves in clinical dental practice. *Infection* 2000;28:388–392.
8. Jamal A, Wilkinson S. The mechanical and microbiological integrity of surgical gloves. *ANZ J Surg* 2003;73:140–143.
9. Korniewicz DM, El-Masri MM, Broyles JM, Martin CD, O'Connell KP. A laboratory-based study to assess the performance of surgical gloves. *AORN J* 2003;77:772–779.
10. Burke FJ, Baggett FJ, Lomax AM. Assessment of the risk of glove puncture during oral surgery procedures. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1996;82:18–21.
11. Avery CM, Hjort A, Walsh S, Johnson PA. Glove perforation during surgical extraction of wisdom teeth. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;86:23–25.
12. Schwimmer A, Massoumi M, Barr CE. Efficacy of double gloving to prevent inner glove perforation during outpatient oral surgical procedures. *J Am Dent Assoc* 1994;125:196–198.
13. Patton LL, Campbell TL, Evers SP. Prevalence of glove perforations during double-gloving for dental procedures. *Gen Dent* 1995;43:22–26.
14. Gerberding JL, Littell C, Tarkington A, Brown A, Schechter WP. Risk of exposure of surgical personnel to patients' blood during surgery at San Francisco General Hospital. *N Engl J Med* 1990;322:1788–1793.
15. CDC. Guidelines for infection control in dental health-care settings – 2003. *MMWR* 2003; 52(No. RR-17):1–66.
16. Klein RC, Party E, Gershey EL. Virus penetration of examination gloves. *Biotechniques* 1990;9:196–199.
17. Gani JS, Anseline PF, Bissett RL. Efficacy of double versus single gloving in protecting the operating team. *Aust N Z J Surg* 1990;60:171–175.
18. Short LJ, Bell DM. Risk of occupational infection with blood-borne pathogens in operating and delivery room settings. *Am J Infect Control* 1993;21:343–350.
19. Tokars JI, Culver DH, Mendelson MH, et al. Skin and mucous membrane contacts with blood during surgical procedures: risk and prevention. *Infect Control Hosp Epidemiol* 1995;16:703–11.
20. Tanner J, Parkinson H. Double gloving to reduce surgical cross-infection (Cochrane Review). *The Cochrane Library* 2003;(Issue 2):1–32.
21. Webb JM, Pentlow BD. Double gloving and surgical technique. *Ann R Coll Surg Engl* 1993;75:291–292.
22. Watts D, Tassler PL, Dellon AL. The effect of double gloving on cutaneous sensibility, skin compliance and suture identification. *Contemp Surg* 1994;44:289–292.
23. Wilson SJ, Sellu D, Uy A, Jaffer MA. Subjective effects of double gloves on surgical performance. *Ann R Coll Surg Engl* 1996;78:20–22.
24. Food and Drug Administration. Guidance for industry and FDA: medical glove guidance manual [Draft guidance]. Rockville, MD: US Department of Health and Human Services, Food and Drug Administration, 1999.