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Major article

A study of clinicians' views on medical gloves and their effect on manual performance

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Background: The effect of gloves on practitioners' performance has not been a major factor in their design. To determine the critical elements of performance and design appropriate tests, data from clinicians were needed.
Methods: Semistructured interviews were carried out with medical practitioners from various disciplines, in which they were asked about their glove use, their views on gloves, medical tasks requiring the highest manual performance or most affected by gloves, and what the main issues with glove use were.
Results: Many participants expressed a preference for latex over nitrile, with glove fit being the main reason given. Satisfaction with surgical gloves (generally latex) was high but less so with examination gloves, which were generally nitrile. Tactile sensation, comfort, and donning were also seen as major issues with glove use. A number of tasks were identified for possible development as tests.
Conclusion: Performance in medical practice needs to be clearly defined, separating perceived and measured performance, and understanding the effect of glove material, fit, and thickness. Development of new glove performance tests based on the tasks identified is an important part of this.

Broadly speaking, there are 2 types of medical gloves: examination gloves, which are ambidextrous, usually nonsterile, and come in a small range of sizes, are used for nonsterile and less dextrous tasks and also for most dental work; surgical gloves are sterile, come individually packaged in handed pairs, and are usually available in half-inch intervals of hand girth. They are used in the operating theater for a variety of dextrous tasks, ranging from microsurgery on the eye or ear to bone setting or hip replacement.

Because the majority of clinical work is not perceived to be as dextrous as surgery, less emphasis is placed on the performance of examination gloves. Until recently, both examination and surgical gloves were generally made from natural rubber latex (commonly referred to as "latex"), although alternatives were available for known cases of latex allergy. However, the lack of regulation of manufacturing processes in the early years of mass production meant that gloves often contained a high level of allergenic proteins, which led to a steady increase in the number of cases of latex allergy reported.[1]

Current guidelines from the National Health Service and the Royal College of Physicians[2] in the United Kingdom state that "the evidence does not … support a need to ban latex completely from the workplace." They note that nonlatex surgical gloves "have higher failure rates in use and lower user satisfaction than latex gloves." Instead, they advocate the use of nonpowdered, low-protein latex gloves, except for employees with latex allergy, latex sensitization, or latex-induced asthma, where nonlatex alternatives are recommended. However, most primary care health care groups and hospitals in the United Kingdom have replaced latex in nonsurgical situations with less flexible alternatives[3] such as nitrile to remove the risk of latex allergy in patients and practitioners.

Similarly, the American College of Allergy, Asthma, and Immunology[4] recommends that "a facility-wide review of glove usage should be undertaken to determine the appropriateness of use … and thereby prevent the unnecessary use of latex gloves" and advocates nonpowdered, low-protein gloves as standard in a health

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care facility but also states that "hospitals need to evaluate manufacturer information on nonlatex gloves in areas of durability, barrier protection, and cost" because "latex is still considered superior with respect to barrier characteristics against transmissible diseases." Surgeons have generally resisted moves to replace surgical gloves in the same way because of the perceived reduction in manual performance when using nonlatex alternatives.

With respect to the glove design process, there is little or no evidence that gloves are evaluated in terms of their effects on users' manual performance. All the currently available standards[5,6] focus on the barrier integrity of the gloves by defining tensile strength, freedom from holes, and tear resistance. Similarly, much of the research on medical gloves has concerned barrier integrity[7,8] and adherence of practitioners to handwashing and glove handling guidelines.[9,10] Clearly, because the primary role of the gloves is to prevent the spread of infection, it is important that the design brief takes these things into consideration, but achieving good barrier integrity is not necessarily incompatible with achieving the best performance.

Glove performance also has an effect on safety, particularly in a surgical environment. Surgeons using gloves with less-than-optimal frictional properties, for example, may be more likely to drop instruments, to slip when performing delicate procedures, or to increase their stress levels when attempting to compensate. Similarly, practitioners who cannot feel a pulse through gloves when taking blood will be more likely to remove the gloves and increase their risk of infection. A 1994 survey of health care workers[11] found that a "perceived interference with technical skills" was a common obstacle to compliance with universal precautions. There is also a subjective element to the performance that must be considered, which is that practitioners' comfort and confidence in their gloves may affect their concentration levels and therefore their ability to perform surgery over extended periods of time.

It is vital that the glove design process includes an assessment of their effect on manual performance to ensure that practitioners can operate safely and efficiently. The first step in this process is to determine the key aspects of manual performance in medical practice and where current gloves have a significant adverse effect. The second is to design tests that are useful predictors of clinical performance. It is therefore necessary to identify the tasks that are most challenging and on which gloves are thought to have the greatest impact so that the tests can be designed to simulate relevant manual skills.

To achieve this, semistructured interviews with medical practitioners were carried out. As well as gathering information on the participants' roles, disciplines, and glove use, a series of open-ended questions were used to identify tasks believed by users to require the most dexterity and tactility, and those most affected by glove performance, as well as any other issues related to gloves that might aid the study. The interviews took place within Sheffield Teaching Hospitals NHS Foundation Trust (STH) and received ethical approval from the research ethics committees of STH and The University of Sheffield, UK.

Focus groups were considered as a means of gathering data fairly quickly and stimulating discussion. However, the limited availability, particularly of senior staff, made this a difficult approach. Furthermore, it has been shown[12] that, when recruitment, transcription, and analysis are included, focus groups can be much more time-consuming than individual interviews. Although focus groups are generally accepted to produce a wider range of responses, this is not always the case and depends on the nature of the questions.[12,13] In this study, many of the questions were of a technical nature and specific to the individual's specialty. There was also a concern that participants' opinions on specific gloves would be influenced by those of their colleagues.

Interviews were therefore conducted on a one-to-one basis to increase flexibility and enable senior staff to participate at their own convenience, often between operations or appointments. The questions were designed to be sufficiently open-ended so that the participant was not led down one particular line of thought but also included prompts where information was not forthcoming. With a wide enough selection of participants, it was hoped that a consensus would be formed in at least some of the areas, which would enable judgments to be made on the most productive direction for future research.

METHODS

Participants were approached by e-mail, and interviews were conducted at their place of work. The duration of the interviews varied between 6 and 28 minutes. Audio from the interviews was recorded and transcribed at a later date.

An interview guide was created for the study. Participants were asked about the following:

- Their examination glove use and surgical glove use: frequency, current type(s) used, preferences, activities for which they are used, grasp types used (Cutkosky's taxonomy of grasp types[14] was used as a guide [see Fig 1]);
- tasks requiring most manual dexterity, tactile sensation, and hand fatigue and those most affected by wearing gloves tasks most likely to cause tearing;
- what they considered to be the main issues with glove use;
- their perception of how various glove properties affect performance;
- special precautions regarding glove use when risk of infection is high; and
- other issues or incidents that would be helpful to know.

Participants from a range of disciplines and roles were included so that there was a better chance of determining the particular areas where the use of gloves causes difficulty. It was also desirable to have a range of experience in the practitioners because those with a lot of experience may have different issues with gloves and find different tasks harder. Preference for glove type was also expected to vary because it was thought that the conditions in which practitioners train have an effect on their future preference.

No fixed sample size was set because recruitment was constrained by time and availability of participants, and more participants were recruited in those areas that yielded more useful data as the study progressed. For example, there was a much broader range of tasks and opinions among orthopedic surgeons than among anesthetists. Thirty-five medical practitioners were eventually interviewed. Table 1 shows a breakdown of the participants by discipline and position.

RESULTS

Results are displayed in terms of percentage of users who gave each response. However, it should be noted that, because of the informal nature of the interviews, not every participant answered every question, and some responses covered a number of points. Therefore, the percentages will not add up to 100, but give an indication of the relative frequency and importance of responses.

Examination gloves

Examination gloves were used for a variety of tasks including performing examinations, using power tools such as a dental hand piece (eg, for drilling) and precision tools such as forceps (eg, for