



The Effects of Double Gloving on Microsurgical Skills

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ABSTRACT

Objectives:

This study's principle aim was to determine whether double gloving would negatively impact participants' ability to perform a simulated microsurgical task.

Study Design:

Randomized, controlled cross-over trial

Methods:

This study revolved around the insertion of a stapes prosthesis into a model of the ossicular chain under microscopy. Participants were recruited from our medical and dental school and randomized into two groups. All groups began by performing the task without gloves. Group A then performed the task with a single pair of gloves while Group B first performed the task with two pairs of gloves. The total time taken to perform the task was recorded for each participant and the results subjected to a series of statistical measures.

Results:

Our study found a statistically significant difference in the average time taken to complete the task between trials without gloves (control) and trials in which participants wore a single pair or two pairs of gloves ($p=0.0044$ and $p=0.0050$ respectively) but no difference between single- and double-gloving ($p=0.4919$). Likewise, no significant difference was found between the two experimental groups (starting with single versus double gloves) when comparing the rate at which they improved at performing the task ($p=0.8692$).

Conclusions:

The efficacy of double gloving as a safety measure has been well established by previous authors. Our study suggests that wearing two pairs of surgical gloves does not negatively affect the ability to perform a microsurgical procedure, lending support to the practice of double gloving, even in the setting of fine motor tasks.

INTRODUCTION

Wearing a second pair of surgical gloves in the operating room has been shown to effectively reduce the risk of transmission of infectious diseases between surgeon and patient.¹ Despite the substantial evidence supporting double gloving, however, concern remains that a second pair of gloves may make surgeries requiring higher levels of delicate manipulation more difficult²⁻⁷. Multiple studies have addressed this issue, but offered widely varying results and primarily surveyed sensation or gross motor skills applicable to normal surgery⁸⁻¹⁰.

One area which has yet to be studied is the relationship between double gloving and microsurgery. In this specialized form of surgery, delicate tasks are performed under microscopy. The success of these procedures often depends upon fine movements of the hands and great control of the amounts of pressure applied to sensitive structures. One such procedure is a stapedotomy, in which a stapes prosthesis is inserted into a small hole in the oval window of the cochlea. Improper performance of this procedure may lead to poor results and even deafness. Our study attempts to test the effects of double gloving on performance of a simulated stapedotomy.

MATERIALS AND METHODS

This study was conceived as a randomized, controlled, crossover trial. It revolved primarily around performance of a simulate stapedotomy on a model of the ossicular chain. This plastic ossicular model and a supply of Smart Stapes Pistons were provided by Grace Medical (Memphis, Tennessee) (Figure 1). Gloves were provided by Ansell Healthcare LLC (Iselin, New Jersey) which were in use in the operating room at Virginia Commonwealth University.

Our 41 participants were recruited from our medical and dental schools and randomized into two groups. All groups began by performing the task without gloves, acting as this own control arm. The first group then performed the task with a single pair of gloves while the second group next performed the task with two pairs of gloves (Figure 2). The total time taken to perform the task was recorded for each participant.

Demographics of the participants including gender, year of medical school, hand dominance, hand injury (yes or no), video games (yes or no), number of times participating in surgery (0, 1-5, 6-10, or >10 times), and microsurgery experience (yes or no) were summarized by frequency and proportion. Difference in amount of time between one pair and two pairs was calculated and summarized by mean, median and range. A paired t-test was used to assess whether there is any difference between the single vs double gloving in overall performance or rate of learning. A multiple linear regression was also used to adjust for any potential risk factors such as history of video games and times of performing surgery. A repeated measure analysis of variance via a linear mixed model was used to compare whether or not there is a time trend, adjust for the potential confounders.

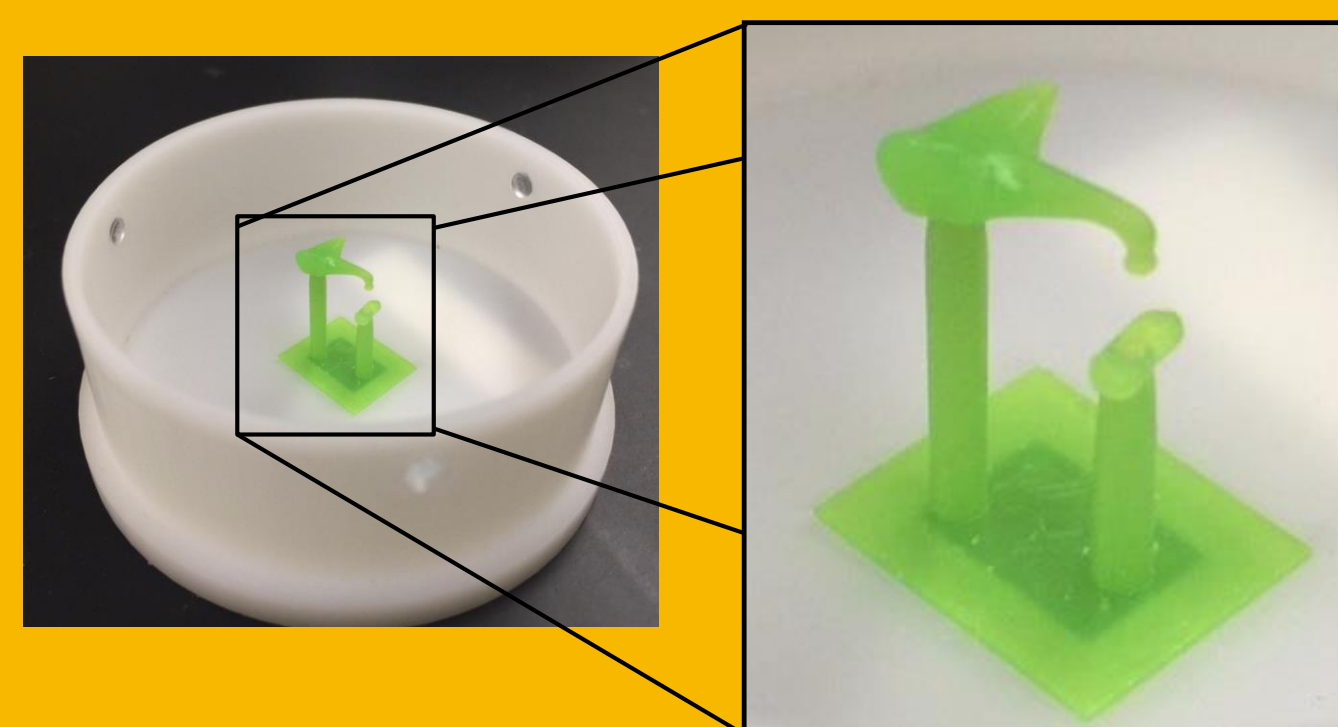


Figure 1: Model of the ossicular chain for simulation of stapedotomy (Grace Medical, Memphis, Tennessee)

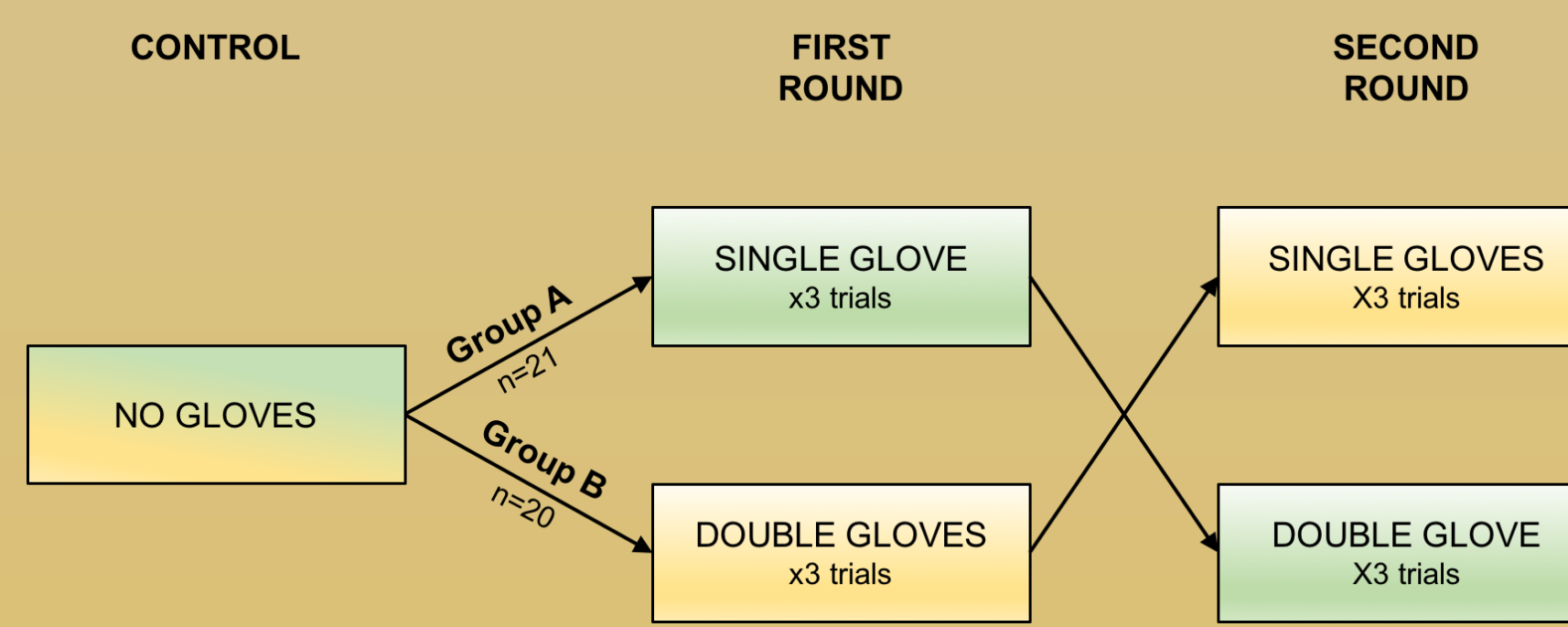


Figure 2: Study design, showing the two randomized groups (A and B).

RESULTS

In our study of 41 participants, we found a statistically significant difference in the average time taken to complete the task between the "no glove" control arm of the study and both the "single-" and "double-glove" arms ($p=0.0044$ and $p=0.0050$ respectively). No difference was detected, however, when single- and double-gloving were directly compared ($p=0.4919$). This provides convincing evidence that wearing gloves made performing our task more difficult, but that wearing an additional pair of gloves makes no significant difference.

Next, we compared the two experimental groups (A and B) in terms of the rate at which they improved at performing the task based on whether they started with one or two pairs of gloves after their initial "no glove" control arm. Once again, no significant difference was found between the experimental groups ($p=0.8692$) (Figure 3).

Survey results were largely non-contributory. The patient's year in medical / dental school had no significant relationship with completion times for the task ($p=0.0957$). Playing video games was also not shown to have a statistically significant relationship to completion times ($p=0.2453$). Similarly, previous participation in surgery had no relationship to completion times ($p=0.3826$).

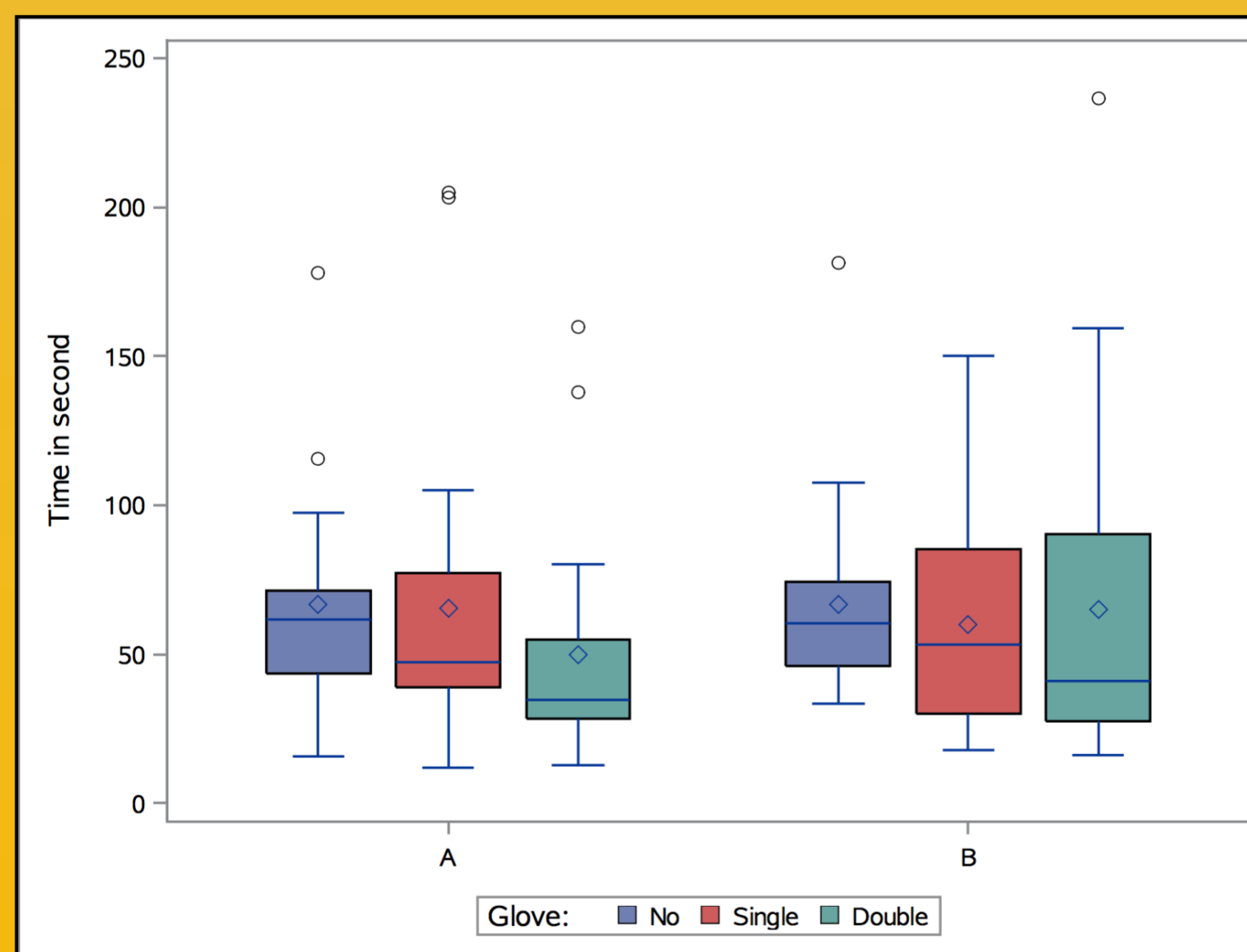


Figure 3: Box plot of comparing mean completion time with no gloves, single gloves and double gloves from Group A (single glove first) and Group B (double glove first). The error bars represent standard error.

DISCUSSION

The wearing of a second pair of protective gloves during surgery is quickly becoming an accepted practice at many institutions worldwide for prevention of infectious disease due to glove tears or sharps injuries. In the 2007 Statement of Sharps Safety published by the American College of Surgeons, the College advocates the universal adoption of the double glove technique¹. The protection offered to surgeons and patients by double gloving is multi-faceted. An additional pair of gloves can provide a mechanical barrier to puncture, a back-up barrier against direct blood exposure or cross-contamination in the event of outer glove failure, and has even been shown to reduce the volume of the inoculum of suture needles by partially cleaning needles as they pass through multiple layers of gloves². The effects of double gloving have been widely reported in surgical literature, with the vast majority of studies demonstrating significantly decreased intraoperative exposure to blood when compared to single gloving³⁻⁷. Indeed, in one randomized control trial, investigators noted a failure rate (blood exposure to the hands) of only 7% when two pairs of gloves were worn versus a 51% failure rate with a single pair³.

Despite substantial evidence outlining the benefits of double gloving, however, this practice has remained a controversial subject. In fact, the same ACS report that calls for universal double glove acknowledges that, "in certain types of surgery where delicate manipulation of instruments and tissue is required, double gloving may impair the surgeon's ability to safely perform the procedures"¹. This highlights the principal argument cited against double gloving, which is that the additional layer of material impairs sensation and manual dexterity. A number of recent studies have investigated these claims with mixed results. To quantitatively assess sensation, past investigators have utilized a moving two-point discrimination test designed for use in neurologic assessments of the hand⁸, with neither study showing a clear difference in sensation when wearing one or two gloves⁹⁻¹⁰. To assess dexterity, studies have used a variety of techniques, including the Purdue Pegboard test¹⁰, knot tying¹¹, and gross motor tasks¹². These studies once again showed mixed results, with some demonstrating a significant difference in the amount of time needed to accomplish tasks and the number of errors that occurred, and others showing no difference at all.

Our study is the first to examine the effects of double gloving on a particular microsurgical skill using a simulated surgical procedure, in this case a stapedotomy. No difference was detected when single- and double-gloving were directly compared in terms of completion time ($p=0.4919$). This suggests that wearing an additional pair of gloves does not significantly impair the ability to perform microsurgery. Additionally, other factors including prior exposure to surgery, year of training and amount of video game playing had no bearing on how quickly students performed or learned this task.

CONCLUSIONS

The efficacy of double gloving as a safety measure has been well established by previous authors. Our study suggests that wearing two pairs of surgical gloves does not negatively affect the ability to perform a microsurgical procedure, lending support to the practice of double gloving, even in the setting of fine motor tasks. This is the first study to specifically address double gloving in microsurgery.

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