

Can surgical gloves be made thinner without increasing their liability to puncture?

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A new process has been used to develop Biogel Super-Sensitive® gloves which are thinner but theoretically as strong as standard Biogel® gloves. The two types of glove were compared for their effects on manual sensitivity and dexterity in a randomised controlled trial. The Super-Sensitive gloves impaired sensitivity significantly less than standard gloves but made no difference to the ability to tie knots. No statistically significant difference was shown in the resistance to perforation between the two types of gloves. Surgeons who prefer more sensitive but relatively strong gloves should find the new gloves useful.

Double gloving is one of the measures used to protect surgeons from contamination by tissue and fluids when operating (1,2). However, few surgeons routinely wear double gloves, allegedly because of reduction of tactile sensation and manual dexterity (1,3). One way to encourage surgeons to wear double gloves is to make gloves more sensitive. Moreover, there are operations requiring especially accurate manipulative skills in disciplines such as neurosurgery, ophthalmology and microsurgery, in which even single gloves are believed to hamper performance.

Using a special chemical process in the vulcanisation of rubber, Regent have made a new type of glove, the Biogel Super-Sensitive®. These are thinner than conventional gloves (0.18 mm compared with 0.25 mm) but in theory are no less strong. This study reports the sensitivity

profile of the new gloves and their ability to withstand puncture.

Materials and methods

Studies of tactile discrimination, dexterity and comfort

The design was similar to that used by Webb and Pentlow (4). We assessed two-point discrimination of 21 surgeons using the technique described by Dellon (5). The pulp of the dominant hand index finger was stroked 10 times in random order, five times with a single point, and five times with two points set 2 mm apart. The score was the number of times the surgeon correctly identified the method of stimulation used.

We also tested the ability of the same 21 surgeons to tie knots, scoring the number of hand throws tied in 1 min. We used the same length of 0 and 3/0 Vicryl® (Ethicon, UK).

Each surgeon performed both tests twice, in random order, with standard Biogel gloves and with Biogel Super-Sensitive gloves. Verification of the technique involved testing five surgeons on two separate occasions and comparing the results. Each surgeon was asked to state which of the two types of glove was more comfortable to wear. Data analysis was by Wilcoxon's Rank Sum Test.

Puncture and quality control study

The senior author performed 280 operations, 140 wearing standard Biogel gloves, and 140 with Biogel Super-Sensitive gloves. He carried out a similar type of

operation twice in random order, once with standard gloves and again with Super-Sensitive gloves. If a glove change was necessary during an operation, he used the same type of glove throughout. A glove was changed if he knew or suspected that it was punctured. In colonic surgery, both gloves were changed before wound closure. All gloves were collected at the end of the operation and tested for punctures using an established technique: the glove was filled with 1 litre of tap water and compressed to identify the puncture. In all, 100 unused gloves from each batch were tested similarly. Data were analysed using the χ^2 test.

Results

Tactile discrimination, dexterity and comfort studies

The index fingers of the surgeons were stroked 105 times with one point and the same number of times with two points for each of the gloves. The scores were 64 and 69, respectively, for the standard gloves, with 98 and 99 for the Super-Sensitive type. The retest scores of the five surgeons selected were similar. Super-Sensitive gloves were better than the standard gloves ($P < 0.02$) for each method of stimulation.

There was no statistically significant difference between the number of knots tied in 1 min between the two types of glove, but 20 of the 21 surgeons rated the Super-Sensitive glove as more comfortable to wear.

Puncture study

The most commonly performed operations were anorectal procedures such as haemorrhoidectomy, laying open of fistula-in-ano and lateral internal sphincterotomy (65%), inguinal hernia repair (22%) and colonic resection (5%). The patients in the two gloving groups were well matched for age, sex and type of operation. In all, 339 standard Biogel gloves were used of which 61 (18%) were punctured. This compares with 351 Super-Sensitive

gloves, of which 77 (22%) were punctured. This difference is not statistically significant. There were no manufacturing imperfections in the Biogel gloves, but one puncture was found in the Super-Sensitive gloves.

Discussion

The ideal surgical glove should totally resist puncture and yet allow the surgeon to operate without impairment of manual dexterity and hand sensitivity. Such a glove is not yet available but research is continuing into the production of better gloves from existing and new materials. Natural rubber is still the material of choice, but previous attempts to make it thinner, and thus improve sensitivity, have resulted in gloves with unacceptably low strength. Our findings show that the new Biogel Super-Sensitive glove was more sensitive than the standard glove and that although its puncture rate was higher than the standard glove the difference was not statistically significant. This may be an important finding for surgeons who desire greater manual sensitivity and may encourage the greater use of double gloving.

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