EFFECTS OF MUCIN ON MEDICAL GLOVE TRIBOLOGY AND PERFORMANCE

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ABSTRACT
Medical glove use has changed over recent years. Despite allergy fears, the leading preference of material is still natural rubber latex but, synthetic alternatives have been introduced, such as nitrile [1]. It has been shown that all glove materials can affect the grip, dexterity and the tactile feedback of medical glove users. Some of these materials have been assessed in previous studies, but questions still remain as to the effects of them in different user conditions [2]. Many of the current glove test methods do not include the specific tasks and conditions used within medical procedures. For instance, many test do not consider the bodily fluids that could be present during glove-surface interactions. This study aims to assess how mucin (found in saliva and mucus, around organs) affects the sensitivity and dexterity of latex and nitrile medical glove users. This study also seeks to assess how the frictional behavior of the gloves change in the presence of such fluids.

15 subjects took part in the dexterity assessments whilst 10 took part in the sensitivity assessment. Sensitivity was assessed using a "bumps" perception test, which is described in Mylon *et al* [4]. Gross dexterity was measured using the Purdue Pegboard test whilst fine dexterity was measured using the Crawford Small Parts Dexterity Test. Five gloving conditions were used for the assessment: bare hand, latex, nitrile (both dry), and latex, nitrile (both with a 10mg/ml concentration of porcine gastric mucin applied). Frictional properties were assessed by having one participant run their finger over a polished steel strip (Ra 0.11µm) with a normal force ranging from 1 to 5N. Latex showed a decrease in sensitivity and gross dexterity with a higher friction coefficient at lower loads when mucin was applied. Nitrile, on the other hand, showed an increase in dexterity when mucin was applied across the sensitivity test and both dexterity tests. The friction coefficients at all loads used were lower when mucin was applied to the nitrile gloves. As mucin is a protein, it undergoes conformational changes and this particular protein has the ability to form muco-adhesive films, which appeared to be more pronounced at higher loads as the friction increased over time, as seen in Figure 1. This was more evident in the latex over the nitrile material. The results of this study show that bodily fluids having an effect on glove user's dexterity and sensitivity and this is linked to change in tribological behaviour.

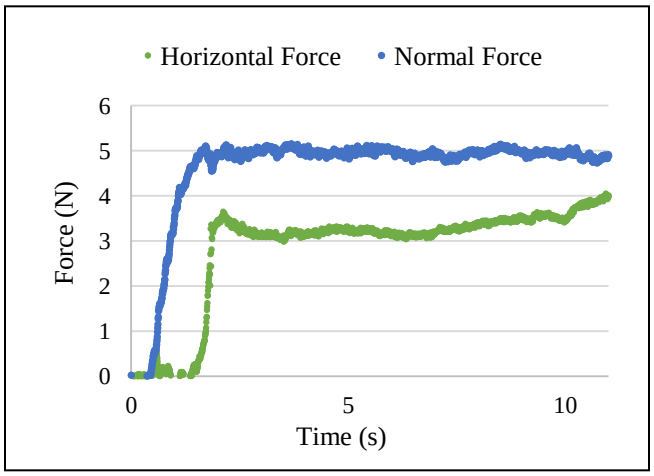

Fig 1. Example of raw data from sliding of latex glove across steel strip with mucin present.

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REFERENCES
[1] Bagg J. (2001). For those of you allergic to latex, nitrile could be the glove material for you. *Br. Dent. J.* 190, 7, 2001, 371.
[2] Mylon, P, Lewis R, Carré M.J, Martin N. A critical review of glove and hand Research with regard to medical glove design. Ergonomics. 57, 1, 2013, 116-129.
[3] Mylon P, Carré MJ, Martin N, Lewis R. How do gloves affect cutaneous sensibility in medical practice? Two new applied tests. *Proc. Inst. Mech. Eng. J*. 231,1, 2017, 28-39.