

**Commentary on:** Lee GSH, Brinch KM, Kannangara K, Dawson M, Wilson MA. A methodology based on NMR spectroscopy for the forensic analysis of condoms. *J Forensic Sci* 2001;46(4): 808–21.

Sir:

I read with great interest the paper by Dr. Garry S. Lee et al., “A Methodology Based on NMR Spectroscopy for the Forensic Analysis of Condoms.” I believe their NMR method may have potential applications far beyond what even the authors envision. One example is when questions are raised regarding the veracity of DNA evidence. Some recent reports (1–3) have explored the confusion that can arise in DNA evidence when the suspect has attempted to outwit it by selling, exchanging, or mixing semen samples.

With NMR we may now have a simple method (yes, the instrumentation is expensive, but the extraction and method are simple) that in one test can provide a profile of residues one might obtain from different brands of condoms. In one case (1) where there was a seminal fluid stain on the victim’s blue jeans, whose DNA did not match that of the suspect, an unused portion of the stain could have been cut-out and extracted with hexane. Some other areas (where no seminal fluid or any other type of stain was visible) of the blue jeans could have been used as controls and extracted separately with hexane. After the hexane had been evaporated off, the residues could have been dissolved in an appropriate NMR solvent and examined. Comparison of the peaks from the controls and the seminal fluid stain would tell us which peaks were due to substances generally present on the jeans (for example, detergent residues) and those that might have been associated with condom traces. It is very unlikely that seminal fluid would interfere with this comparison. It does not interfere with identification by FTIR and/or desorption chemical ionization mass spectrometry (4) of the silicone oil, polydimethylsiloxane (PDMS), after extraction with dichloromethane and hexane is an even less polar solvent.

By comparison with a library of the NMR profiles of various condom brands (the authors correctly point out that such a library would have to be maintained), it might not only be possible to identify various components (PDMS, polyethylene glycol, nonoxynol-9, etc.), but also be feasible to at least profile a condom from a particular manufacturer (even if there were several different brands made by this manufacturer.)

I believe strongly in the potential of this NMR method; however, I do feel it is necessary to point out a small omission in the paper. In the first paragraph at the top of page 809 the authors state: “There are two types of lubricants used on condoms—those based on PDMS and those using polyethylene glycol 400 (PEG).” Actually I am aware of at least two others. Perhaps most Trojan brands (Carter-Wallace) are not available in Australia (the authors only list the “Naturalamb” Trojan brand.) I do not know their exact market share, but various Trojan brands are large sellers in the USA. Although Carter-Wallace uses PDMS in those brands that are advertised as just “lubricated”, their chemists feel that PDMS and nonoxynol-9 are incompatible. Therefore in those brands that contain this spermicide, a water-soluble gel-type lubricant is used. This lubricant contains many ingredients, but by far its major one is propylene glycol (please note that this is not the polymer PEG). In addition, I believe there are several brands sold outside the USA that contain glycerol as a lubricant.

This minor correction in no way detracts from the excellence of the paper. In fact, the greater diversity among condom lubricants can only increase the discriminatory value of their NMR method. The many components in the gel-type lubricant used by Carter-Wallace should especially provide a unique NMR signature. Propylene glycol and glycerol are both quite polar and very water-soluble; the authors might wish to try extracting these condoms with a polar solvent and dissolving the residue in a polar NMR solvent.

## References

1. Blackledge RD, Letter to the editor: DNA versus fingerprints. *J Forensic Sci* 1995;40(4):534.
2. Personal communication. Deputy District Attorney Eleanor Hunter, State of California vs David Wayne Arisman, and newspaper stories in the *Daily Breeze* (Torrance, California) between 26 August 1997 and 16 January 1999.
3. Willing R. Criminal try to outwit DNA, *USA Today*, 28 Aug. 2000.
4. Blackledge RD, Vincenti M. Identification of polydimethylsiloxane lubricant traces from latex condoms in sexual assault. *J Forensic Sci Soc* 1994 Oct/Dec;34(4):245–56.

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