

Silicone oil found in syringes commonly used for intravitreal injections

Óleo de silicone encontrado em seringas comumente usadas para injeções intravítreas

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INTRODUCTION

The manufacturing process of most commercially available syringes relies on siliconizing the inner surface of the syringe barrel in order to reduce the force that initiates plunger movement and its subsequent gliding⁽¹⁾. Silicone oil (SO) has been recently found in the vitreous. Its presence is often benign, but might become symptomatic, leading not only to floater symptoms, resulting in vitrectomy and its associated risks, but also to a significant intraocular inflammatory reaction⁽²⁾.

This study assessed whether the three commonly used syringe models contained SO.

METHODS

Three models of two syringe brands were analyzed for the presence of SO: Saldanha-Rodrigues (SR) 1-mL insulin syringe (Saldanha-Rodrigues, Manaus, Brazil, lot #3719K); BD Plastipak 1-mL insulin syringe (Becton, Dickinson [BD] and Co., Curitiba, Brazil, lot #6218341), and BD SafetyGlide Insulin 1-mL syringe (BD and Co., Holdrege, NE, lot #8010798).

The plungers were removed, and the rubbers on their tips were gently rubbed onto a cesium iodide crystal to obtain the possible oil contents. The Fourier-Transform Infrared (FTIR) Spectroscopy Nicolet iS10 (Thermo Electron Scientific Instruments LLC, Madison, WI) was used to assess the cesium iodide crystal, with band ranging

from 4,000 cm^{-1} to 400 cm^{-1} , with 4 cm^{-1} resolution and 32 scans.

RESULTS

The analysis of materials indicated the presence of polysiloxane (i.e., SO) in all syringe models tested (Figure 1). The following characteristic bands were found: 2,960 cm^{-1} , stretching CH₃ vibrations in Si-CH₃; 1,260 cm^{-1} , bending CH₃ vibrations in Si-CH₃; 1,090 cm^{-1} and 1,020 cm^{-1} , asymmetric stretching Si-O-Si vibrations; and 800 cm^{-1} , stretching Si-C vibrations in Si-CH₃.

The BD Plastipak syringe had an additional band in the 1,740 cm^{-1} region, typical in the stretching C=O vibrations of the esters in carboxylic acid at small proportions.

DISCUSSION

SO droplets released during intravitreal injections have been reported with symptomatic floaters and possibly associated with a more serious clinical condition, i.e., intraocular inflammatory reaction resembling endophthalmitis⁽²⁾. The syringes are considered as the most likely source for these SO droplets.

Our group recently evaluated the effects of agitation by flicking in the release of SO with the same syringe models from the same lot. SO was found in both the BD SafetyGlide and SR samples, especially when agitated⁽³⁾, but not in the BD Plastipak syringe using the light microscopy. The current study was then conducted to chemically assess the presence of SO by the FTIR, showing that all three models have SO in its interior.

Our group also conducted a similar analysis in eight of the most commonly used syringes worldwide with SO found in and released by many of them and highlighted

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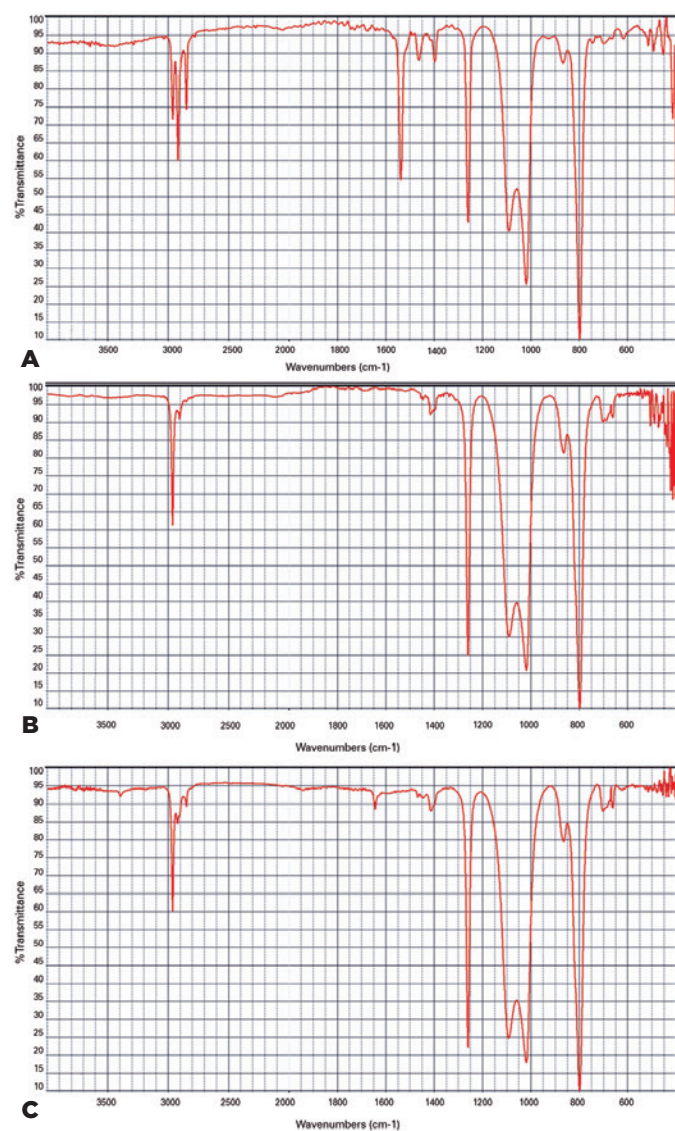


Figure 1. Fourier-transform infrared spectroscopy graph shows the characteristic bands of polysiloxane (silicone oil) in all syringes. A) Becton-Dickinson (BD) Plastipak; B) BD SafetyGlide; C) Saldanha-Rodrigues (SR).

the effects of agitation by flicking on the SO release⁽⁴⁾. Additionally, priming the plunger, different temperatures, and presence of air bubbles (without agitation) had little impact on the release of SO by the syringes. However, agitation by flicking had a tremendous impact. In the agitation group, the presence of air also showed an incremental effect on the release rate. Some syringes tested, including the BD tuberculin 1 mL, Exel 0.3 mL, and Braun Injekt-F 1 mL syringes, released less SO as compared to other models. Interestingly, three out of 60 oil-free syringes were positive for SO by the light microscopy. The source was later found to be the needle used⁽⁵⁾. All syringes, except for the oil-free model, had SO detected by FTIR.

The current analysis confirms that SO is present in all tested syringe models. Therefore, ophthalmologists should be aware that these syringes tend to be coated with SO, and a potential risk of displacing some droplets into the eye may exist.

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