

Sterility of Surgical Loupes Straps: Cloth Versus Nylon Monofilament

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Abstract

Aim: The purpose of this study is to evaluate the Hygienic safety of cloth straps as compared to the straps made with monofilament nylon strap used to secure surgical loupes to the head.

Methods: We cultured the dust or the debris found on the cloth strap and nylon monofilament strap on blood agar, first, by gentle tapping the straps from above the dish, and secondly, by touching the straps directly onto the agar plate. Then, the nylon straps were cleaned with an alcohol swab and the procedure was repeated. The blood agar plates were incubated for 5 days at 35°C in 6.0% CO₂ Agar plates were checked with naked eye for bacterial growth on days 1 and 5. When growth was noted, the plates were gram stained and the colonies were counted.

Results: After 24 hours of incubation, bacteria were growing in both of the cloth tap and touch plates whereas no bacterial growth was noted in the Nylon straps tap and touch plates. At the end of the 5-day incubation period, no bacterial growth was noted in either of the nylon strap agar plates.

Conclusion: Nylon straps are safer to use than cloth straps because they are not contaminated with any bacteria that could be cultured. Nylon monofilament straps are easy to clean. The authors advocate the use of the Nylon monofilament straps in surgical situations as nylon strap would create less of risk or surgical contamination making them more sanitary and much safer to use than cloth straps.

Keywords: Surgical Loupes Straps; Cloth; Nylon Monofilament

Introduction

Surgical loupes are widely used in the fields of medicine and dentistry. Surgeons invest in their surgical loupes and may use them for years. Much advancement has been made in the loupe design in the last decade. However, most professionals still prefer to use a cloth strap to secure the loupes to their head. There is no standardized protocol for regular cleaning of the cloth straps. Because of the possibility of introducing bacterial infection from the straps to the patient during surgery, we wanted to determine how clean the cloth straps are as compared to the new nylon monofilament strap design.

The proprietary Suh-Hermesen strap was made from extruded nylon monofilament, which is a very flexible, easy-to-clean and light-weight material. Monofilament is a single, continuous strand (filament) of synthetic fiber. Strap connectors were 3D printed from a proprietary material that is flexible and durable. The connectors that attach to the temple are at a 30 degree offset or incline (Figure 1). The most commonly recognized monofilament is nylon fishing line, but monofilament is used in numerous ways.



Figure 1: Pictures of a cloth strap and a monofilament strap.

Materials and Methods

We conducted this study at the microbiology department at the Children's Hospital and Medical Center in Omaha, Nebraska. The plating method was as follows. We tested one cloth and one Nylon strap, the cloth strap was used for more than 15 years and the Nylon for 5 years. The cloth strap was tapped at a distance of 8 cm over a blood agar plate (BAP) and then it was touched onto the surface of a second BAP plate. The same procedures were performed with the nylon strap. The Nylon strap was then cleaned with an alcohol swab and allowed to dry. Then, the cleaned Nylon strap was tapped and touched in two different BAPs respectively. Alcohol swab was not used to clean the cloth straps as it would soak the cloth strap and make it more susceptible for dust and bacteria to cling to it.

A total of 6 culture plates were used. The BAPs were incubated at 35°C in 6% CO₂, stained, and the total colonies were counted. The plates were monitored at day 1 and day 3 for growth. The gram staining was performed using the standard Gram Stain protocol at our hospital (Crystal violet stain, Grams Iodine, decolorization with acetone, counterstain with safranin.) Blood agar was used in this study as it can grow the majority of the organism responsible for ocular infection.

This study was exempt from IRB review at the University of Nebraska Medical Center and was performed in accordance with the Declaration of Helsinki.

Results

Agar plates were checked with the naked eye for bacterial growth on days 1 and 3. Bacterial growth was noted at day 1 and day 3, the plates were gram stained and the colonies were counted (Figure 2 and 3).

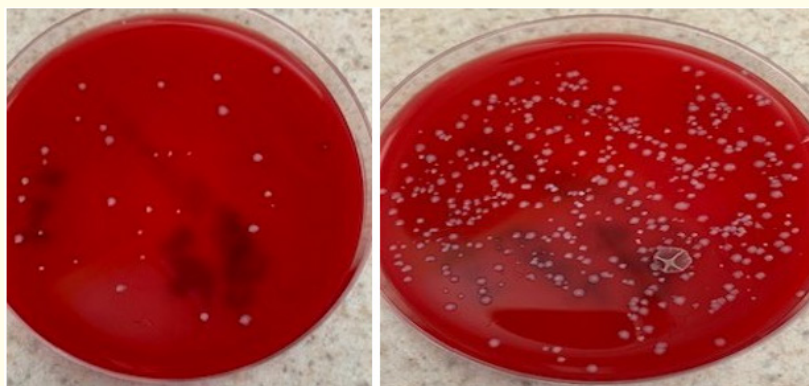


Figure 2: Pictures showing bacterial colonies growing on the cloth strap tap and touch agar plates at day 1.

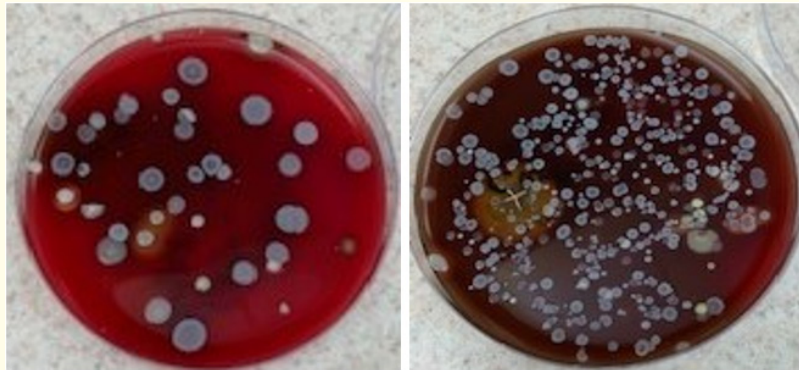


Figure 3: Pictures showing bacterial colonies growing on the cloth strap tap and touch agar plates at day 5.

Our study found over 100 colonies growing on the blood agar plates tapped from above and touched with the cloth straps. There were several morphologies of staphylococcus species and gram positive rods. The numbers of colonies of each type are listed in table 1. We found when testing the Nylon strap, there was no bacterial growth on the blood agar plates when the strap was tapped from above and no growth when it was tapped and touched respectively after cleaning it with alcohol swab. There was a single colony consisting of gram-positive rod, probable *Bacillus* species present with direct plating of uncleaned Nylon strap. It was an environmental *Bacillus* species. Screening for the staph morphologies for *S. aureus* was performed and all were negative.

Plate	Number of colonies	Gram stain result (number of colonies)
Suh Strap Touch Pre	1 colony	GPR probable Bacillus species
Suh Strap Tap Pre	No growth	
Suh Strap Post	No growth	
Suh Strap Post	No growth	
Cloth Strap Tap	14 colonies	GPC (staph) morphology (1)
	13 colonies	GPC (staph) morphology (2)
	6 colonies	GPC (staph) morphology (3)
	20 colonies	GPR morphology (1)
	1 colony	GPR morphology (2)
	2 colonies	GPC-Micrococcus
Cloth Strap Touch	200 colonies	GPC (staph) morphology (1)
	50 colonies	GPC (staph) morphology (2)
	20 colonies	GPC (staph) morphology (3)
	5 colonies	GPC (staph) morphology (4)
	3 colonies	GPC (staph) morphology (5)
	1 colony	GPR morphology (1)
	2 colonies	GPR morphology (2)

Table 1: Number of bacteria in the different agar plates.

Discussion

Infection following any surgery is not desirable and can have devastating outcomes. As surgeons, we want to take the necessary precautions to maintain a sterile operating environment and surgical field. Microsurgical loupes have been established as safe alternate to surgical microscopes in various general surgical procedures [1]. Ophthalmologist use surgical loupes particularly when performing oculoplastic and strabismus surgery. These cloth straps, which are required to prevent the loupes from slipping from the face and falling into the surgical field, usually have longer straps. There is the possibility that the tail end of these straps can fall into the surgical field while performing an operation.

One can argue that the operating surgeon is conscious and that the tail end never touches the operating field. From our experiment, we have shown that even gentle tapping can dislodge these organisms, making these cloth straps a source of possible bacterial infection and therefore, unsafe.

As mentioned earlier, the cloth straps are not easy to clean and are often not cleaned for years. Therefore, they can harbor bacteria and potentially pathogenic organisms which can be a source of infection.

The bacteria identified from the culture plates were normal, commensal organisms found living on human skin, however, these can cause potentially devastating infections. For example, one of the most common bacteria found on the surface of the eye is coagulase-negative staphylococci (CoNS), which are assumed to be commensal bacteria colonizing the mucosa and lid margins [2]. Other commensal organisms commonly constituting ocular flora are *Staphylococcus aureus*, *Propionibacterium* sp., *Corynebacterium* sp., *Pseudomonas aeruginosa* and *Hemophilus influenzae* [2-4]. A recent literature review looking at the bacterial profile of ocular infections suggests that *Staphylococcus aureus*, CoNS, *Streptococcus pneumoniae* and *Pseudomonas aeruginosa* are the leading isolates in ocular infections [5].

From our study, it is evident that the cloth straps, which are not easy to clean and disinfect, harbor bacteria, while nylon straps, which are much easier to clean and disinfect, do not. In addition, the nylon strap has a snug loop around the head, and there is no chance of the strap falling into the surgical field.

Conclusion

The cloth straps are not easy to clean and can harbor bacteria. The authors advocate that nylon monofilament straps are much safer to use in surgical situations.

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