

Tear fluid collection in dogs and cats using ophthalmic sponges

Lionel Sebbag,* Danielle M. Harrington† and Jonathan P. Mochel‡

*Department of Veterinary Clinical Sciences, College of Veterinary Medicine, Iowa State University, Ames, IA, USA; †Lloyd Veterinary Medical Center, College of Veterinary Medicine, Iowa State University, Ames, IA, USA; and ‡Department of Biomedical Sciences, College of Veterinary Medicine, Iowa State University, Ames, IA, USA

Address communication to:

L. Sebbag

Tel.: (515) 294-4900

Fax: (515) 294-7520

e-mail: lsebbag@iastate.edu

Abstract

Objective To compare the use of two ophthalmic sponges for tear collection in dogs and cats.

Animals studied Ten healthy dogs and 10 healthy cats.

Procedures A strip (4 × 10 mm) of either cellulose or polyvinyl acetal (PVA) sponge was inserted into the ventral fornix of each eye for either 15, 30, or 60 s. The wetted strip was placed into a 0.2-mL tube that was first punctured at its bottom. Tears were eluted through the drainage hole into a 1.5-mL tube via centrifugation. Tear volume absorbed (VA) and tear volume recovered (VR) were calculated as the difference of the post- and precollection weight of the 0.2-mL tube and 1.5-mL tube, respectively. Recovery ratio (RR) was determined as the ratio between VR and VA.

Results Ophthalmic sponges were well tolerated by all subjects. In dogs and cats, median (95% range) VA, VR, and RR were as follows: 44 μL (11–106 μL) and 16 μL (2–43 μL); 27 μL (1–84 μL) and 6 μL (0–29 μL); 64% (7–91%) and 35% (0–86%), respectively. PVA sponges achieved significantly greater VR in cats and RR in both species. All parameters were significantly greater with a collection time of 60 vs. 30 and 15 s. Body weight was associated with VA and VR in dogs but not cats.

Conclusions Polyvinyl acetal is better than cellulose for tear collection given its superior recovery. Ophthalmic sponges could facilitate routine analysis of tear fluid in dogs and cats, although further studies are needed to evaluate the quality of tears obtained with this method.

Key Words: absorption, canine, cellulose, feline, polyvinyl acetal, recovery, tears

INTRODUCTION

Tear fluid is an exciting and growing area for clinical research. In addition to fulfilling multiple functions on the ocular surface (e.g. lubrication, nutrition, and defense against infection), tears can provide critical data for the clinician and scientist. Among many other applications, tear fluid can be examined for drug pharmacokinetics^{1,2} discovery of biomarkers in ocular diseases (e.g. dry eye disease)³ and systemic diseases (e.g. cancer).^{4,5}

Microcapillary glass tubes and Schirmer strips, the two most popular tear collection methods in humans,⁶ have also been described in animals,^{1,5,7} but present several drawbacks. Microcapillary tubes require several minutes of collection to obtain small tear volumes and can result in trauma, especially in uncooperative veterinary patients. Schirmer strips entail post-collection elution and

additional processing steps that could negatively impact the quality of tear analysis.⁸

The optimal method for tear collection in animals should be safe, minimally invasive, rapid, and cost-effective. Ophthalmic surgical sponges fulfill all of these criteria as they are developed for use on the ocular surface, have a rapid and large absorptive capacity, are relatively inexpensive and, following centrifugation, provide tears that are directly available for analysis. Most ophthalmic sponges are made of either cellulose or polyvinyl acetal (PVA).⁹ Cellulose is a natural hydrophilic material, while PVA is a bioengineered polymer formed by hydrolysis of polyvinyl acetate (hydrophobic) into polyvinyl alcohol (hydrophilic) and subsequent acetalization.^{10,11} The variable affinity of these materials for water impacts their ability to absorb tear fluid, but could also interfere with the subsequent release and recovery of the fluid.