Comparison of Bacterial Lipase Activity in the Presence of Eye Lid Cleansers

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Purpose: Blepharitis is a generalized inflammation of the eyelids and lid margins, which can include meibomian gland dysfunction (MGD). Meibomian gland dysfunction is characterized by obstruction or a secretion abnormality of the glands that can lead to tear film instability, inflammation and irritation of the lids and ocular surface. The meibomian glands are sebaceous glands found in the lid margins that produce a lipid-rich secretions known as meibum. Excessive bacterial lipase production can alter and degrade meibum on the lid surfaces and within the eye, potentially leading to tear instability and dry eye disease. Saponification breaks down tear lipids into soaps eyelid cleansers including Clraderm® Johnson’s® Baby Shampoo, NovaBay® Avenova and various other products (containing surfactants, salts, preservatives, fragrance and other additives). Only NovaBay Avenova® (III) Cleanser inactivated the lipase completely, while other products had negligible inactivation effects.

Methods: Each eyelid cleanser was added to a solution of 2 mg/mL of Pseudomonas cepacia lipase. After an hour of incubation at 37°C, the lipase-cleanser solutions were diluted 500-fold into lipase buffer. The lipase activity was determined using the Lipase Activity Assay Kit III (Sigma Aldrich®). A SpectraMax® M5 plate reader was able to continuously incubate the microplate at 37°C and measure the fluorescence (RFU) (nmex/kex = 529/600 nm) every 5 minutes for 1.5 hours after an initial 10-minute incubation period.

Results: In the presence of Clraderm®, Johnson’s® Baby Shampoo, OCuSOFT® Lid Scrub® Original, OCuSOFT® Lid Scrub® Plus, and Theramars® Steril-Lid®, bacterial lipase activity was completely inactivated, not distinguishable from no added lipase (Figure 3). Our study compared the inactivation of bacterial lipase by eye care products used to treat blepharitis and MGD. In this in vitro study, NovaBay® Avenova™ completely inactivated bacterial lipase activity while all other products had minimal effect.

Conclusions: Our study compared the inactivation of bacterial lipase by eye care products used to treat blepharitis and MGD. In this in vitro study, NovaBay® Avenova™ completely inactivated bacterial lipase activity while all other products had minimal effect.

Abstract

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Introduction

Meibomian gland dysfunction (MGD), often referred to as posterior blepharitis, is a frequent cause of inflammation of the eyelids and ocular surface. MGD is caused by obstruction or a secretion abnormal secretion of meibomian glands that run radially within both upper and lower eyelids. Meibomian glands normally secrete meibum, which forms the complex lipid-rich layer of the tear film. Meibum stabilizes the tear structure, reduces evaporation, and can serve as a carbon source for bacteria colonizing lid surfaces. Excessive amounts of bacteria on the lid surfaces can produce suficient lipase, a fat and oil-reducing enzyme, to degrade the structure of meibum, resulting in inflammation and symptoms of dry eye disease. MGD may alter the cornal reflectivity, impairing vision. In addition, increase in bacterial lipase activity has been shown in patients with meibomian gland abnormalities. Standard treatments aim to remedy MGD by improving the flow of meibomian gland secretions, which are rich in essential lipids needed for tear film. Current treatments include warm compresses, lid hygiene, antibiotics, and anti-inflammatory agents.²

Materials & Methods

Each eyelid cleanser was added to a solution of 2 mg/mL of Pseudomonas cepacia lipase (Sigma Aldrich®, St. Louis, MO). After an hour of incubation at 37°C, the lipase-lid buffer solution was diluted 500-fold into lipase buffer. The lipase activity was determined using the Lipase Activity Assay Kit III (Sigma Aldrich®). A SpectraMax® M5 Microplate Reader was used to continuously incubate the microplate at 37°C and measure the fluorescence (nmex/kex = 529/600 nm) every 5 minutes for 1.5 hours after an initial 10-minute incubation period.

Figure 3. Activity of bacterial lipase in the presence of various eyelid cleansers measured in relative fluorescence units (RFU) over time.

References

Disclosures
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