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Acute Conjunctivitis Associated with Biofilm Formation on a Punctal Plug

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Background: Punctal plugs are used for the treatment of tear-deficient type dry eye. We recently examined a case of acute conjunctivitis associated with bacterial biofilm formation on a punctal plug.

Case: A 63-year-old woman diagnosed as having tear-deficient type dry eye came to our hospital with a complaint of soreness in her right eye. Punctal plugs had been inserted into this eye 5 1/2 months previously. On the day of her visit, she presented with acute conjunctivitis.

Observations: In biomicroscopical examination, the top of the punctal plug was seen to be covered with a whitish soft material. Microbiological analysis performed on a part of this material was positive for *Staphylococcus haemolyticus* and *Candida tropicalis.* Scanning electron microscopy of the removed punctal plug revealed widespread bacterial colonization embedded within an extensive extracellular matrix. Treatment consisted of the replacement of the plug, and administration of a combination of antibacterial eyedrops and preservative-free artificial solution. As a result, the acute conjunctivitis cleared up within 1 month.

Conclusions: This case suggests that a punctal plug poses a potential risk of causing the formation of bacterial biofilm. In such a case, replacement of the plug and/or removal of the accumulated materials should be considered. **Jpn J Ophthalmol 2000;44:559–560** © 2000 Japanese Ophthalmological Society

Key Words: Bacterial biofilm, conjunctivitis, dry eye, punctal plug.

Introduction

Punctal plugs are used for the treatment of tear-deficient dry eye.[1] Recently, several types of plugs have been developed that remain in place for long periods of time, resulting in the retardation of tears and in the accumulation and alteration of bacterial flora. Bacterial biofilm is known to be a cause of intractable infection,[2] caused by bacterial organisms covered by an extracellular matrix that they produce. In the ophthalmological field, biofilm has been reported in scleral buckles after retinal detachment surgery,[3] and on soft contact lenses.[4] We report a case of bacterial biofilm formation on a punctal plug taken from a dry-eye patient with punctal plug occlusion.

Case Report

A 63-year-old woman, diagnosed as having non-Sjögren-type tear-deficient dry eye, presented at our hospital complaining of soreness in her right eye. This eye had had punctal plugs (Ready-Set Punctum Plugs-Small; FCI Ophthalmics, Cedex France) inserted in the upper and lower puncta, 5 1/2 months previously, because of severe tear deficiency. The upper plug had been displaced spontaneously, probably due to the granulation formed within the canaliculus. On the day of her visit, she showed acute conjunctivitis with moderate hyperemia and some discharge on the palpebral conjunctiva. On examination, the top of the punctal plug was observed to be covered with a whitish soft material (Figure 1). Microbiological analysis was performed on a part of

Received: December 14, 1999

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Published by Elsevier Science Inc.

0021-5155/00/$–see front matter
PII S0021-5155(00)00214-8

Jpn J Ophthalmol
Vol 44: 559–560, 2000

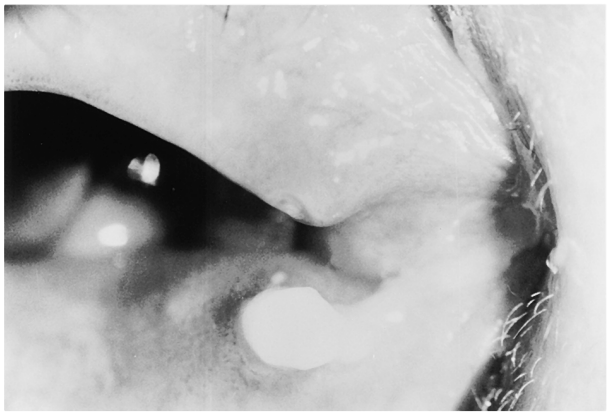

Figure 1. Accumulation of whitish soft material with discharge is present on head of punctal plug inserted in lower punctum.

this material that proved to be positive for *Staphylococcus haemolyticus* and *Candida tropicalis.*

The plug, together with the residual part of the material, was fixed in 2.5% glutaraldehyde and 5% formalin in phosphate buffer and processed for scanning electron microscopy. Examination by scanning electron microscopy revealed that widespread bacterial colonization (spherical bacteria less than 1 μm in diameter) was embedded within an extensive extracellular matrix (Figure 2). Initial treatment consisted of the replacement of the plug with a new one of the same type, and administration of a combination of eyedrops (cefmenoxime hemihydrochloride, ofoxacin and fluconazole, 4 times a day), together with the instillation of a preservative-free artificial solution containing 0.1% KCl and 0.4% NaCl, 6 times a day. During the course of the treatment, the acute conjunctivitis cleared up within 1 month. However, the new plug also became displaced within 1 month after insertion, probably due to granulation, and the patient's corneal fluorescein staining worsened. We then decided to cauterize and suture both the upper and lower puncta and treat the patient with preservative-free artificial tears.

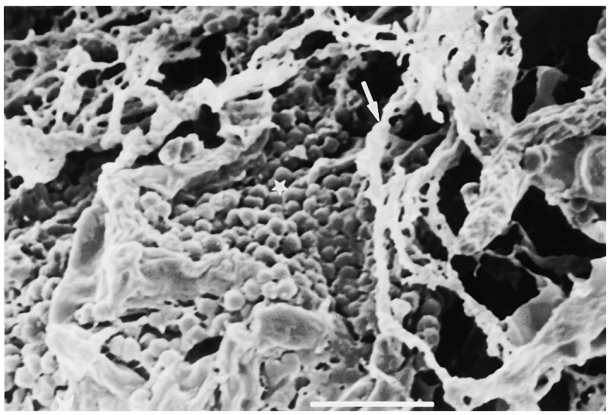

Figure 2. Scanning electron micrograph showing surface of whitish material accumulating on head of punctal plug. This clearly shows widespread colonization by spherical microorganisms (asterisk) associated with sponge-like extracellular matrix (arrow) material. Bar = 5 μm.

Discussion

The use of a punctal plug with an inserter hole often leads to the accumulation of whitish material within the inserter hole that extends to the head of the plug. This suggests that the inserter hole has the potential to act as a pool for pathogenic organisms. These pathogens may be retained in the inserter hole for extended periods, resulting in the production and accumulation of a biofilm, consisting of a colony of these organisms embedded in an extracellular matrix. A lack of defensive factors,[5] such as lactoferrin and lysozyme may contribute to this process. The role of bacterial biofilm in the pathogenesis of punctal plug-related ocular infections is not known. However, this case suggests that there are situations where replacement of a plug should be considered. Alternatively, removal of the accumulated materials may diminish the spread of the infection. We are currently analyzing the material from punctal plug holes from silent cases.

The authors would like to especially thank Anthony J Bron (Nuffield Laboratory of Ophthalmology, University of Oxford, Oxford, UK) for his comments on this work. Supported in part by a research grant from the Kyoto Foundation for the Promotion of Medical Science and the Intramural Research Fund of the Kyoto Prefectural University of Medicine.

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