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REVIEW

The eyelash follicle features and anomalies: A review

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Abstract The primary role of eyelashes is to protect and maintain the health of the lid margin. However, the mechanisms to fulfill this role are not fully understood. Unraveling these mechanisms will stand to greatly improve the efficiency of eye care professionals' interventions in anomalies of the eyelashes. The aim of this article is to provide a review on eyelashes including highlights and new avenues for research; the biology of both the lash and its follicle; the pathophysiology and management of lash anomalies by eye care professionals; and the effect of iatrogenic factors on lashes. Using the database of Ovid MEDLINE, we reviewed studies specifically directed on human/mammalian eyelashes and key articles on current trends in scalp hair methodologies that can be applicable to lash research. The eyelash morphology, pigmentation and growth rate have been documented using techniques ranging from lash imaging to follicle immunohistochemistry. Furthermore, studies have demonstrated that the lash follicle is sensitive to many factors of the external environment, a variety of systemic/topical medications and cosmetics. Recently, aerodynamic studies using a mammalian eye model confirmed that an optimal lash length was needed so that eyelashes serve a protective role in reducing the number of particles that can reach the eye. Despite recent advances in lash research, studies are still scarce, due to the limited availability of the human lid for sampling. This review brings awareness that further research is needed with respect to eyelashes and will hopefully reduce the gap with scalp hair research.

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PALABRAS CLAVE

Pestañas;
Folículo;
Pelo;
Patofisiología de las
pestañas;
Margen palpebral

Características y anomalías del folículo de la pestaña: revisión

Resumen La función principal de las pestañas es proteger y mantener la salud del margen palpebral. Sin embargo, los mecanismos de desempeño de esta función no se comprenden plenamente. Desentrañar estos mecanismos ayudará a mejorar la eficiencia de las intervenciones de los profesionales de cuidados oculares en cuanto a las anomalías de las pestañas. El objetivo de este artículo es aportar una revisión sobre las pestañas, incluyendo los aspectos

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más destacados y las nuevas aportaciones para la investigación, la biología de la pestaña y su folículo, la patofisiología y tratamiento de las anomalías de las pestañas por parte de los profesionales de cuidados oculares, y el efecto de los factores iatrogénicos sobre las pestañas. Utilizando la base de datos de Ovid MEDLINE, revisamos los estudios específicamente dirigidos a las pestañas humanas/de mamíferos, así como los artículos clave sobre las tendencias actuales en cuanto a las metodologías del cuero cabelludo, que pueden aplicarse a la investigación sobre las pestañas. Se han documentado la morfología de las pestañas, así como su pigmentación y tasa de crecimiento, utilizando técnicas que oscilan entre la imagen de las pestañas y la inmunohistoquímica del folículo. Además, los estudios han demostrado que el folículo de la pestaña es sensible a diversos factores del entorno externo, diversas medicaciones sistémicas/tópicas y cosméticos. Recientemente, los estudios aerodinámicos que han utilizando un modelo de ojo de mamífero, han confirmado que se precisaba una longitud de pestañas óptima para que éstas ejercieran su función protectora a la hora de reducir el número de partículas que pueden acceder al ojo. A pesar de los avances recientes de la investigación sobre las pestañas, los estudios son aún escasos, debido a la disponibilidad limitada de párpado humano para muestreo. Esta revisión sirve de concienciación acerca de la necesidad de investigación futura con respecto a las pestañas, que reducirá presumiblemente la brecha existente con respecto a la investigación sobre el cuero cabelludo.

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Introduction

Little research has been done on the human eyelash on account that most of the attention has been directed to research on hair for people suffering from scalp hair loss. However, recent discoveries on the role of eyelashes and its distinctive characteristics have led to an increased scientific interest. Moreover, eyelashes are now considered an important aspect of the facial esthetic and are the object of various beauty treatments to enhance them.^{1,2} Since eyelashes form a barrier between the external and internal environment of the eye, they are extremely sensitive to a variety of threats and irritants and are highly innervated to perform that function.³ Eyelashes are an integral part of the lid margin anatomy, much like the Meibomian glands, eyelid skin and biofilm, each contributing to the overall homeostasis of the ocular surface. As such, it is important to maintain their integrity. As a whole, the lid margin is responsible for the production of the tear film lipid layer and the protection of the eye from external trauma. Via the blink, it distributes the tears toward the nasolacrimal puncta found in the inner portion of the lid margin.⁴ If any part of the lid margin is inflamed, it can induce a tear film disturbance or instability which can, in turn, affect the ocular surface.⁵ Left untreated, this inflammatory cascade can develop into dry eye disease.⁵ Therefore, studying the eyelash and its pathophysiology is valuable for researchers and eye care professionals (ECPs) alike, to maintain ocular surface homeostasis.

An Ovid MEDLINE search for eyelash physiopathology/abnormalities/pathologies has led to 419 human and 59 non-human publications. The articles that were selected for this non-systematic review concentrated on the general biology of the human lash, the prevailing methods in lash

research, lash anomalies and the resulting pathologies with their associated clinical management by an ECP. Also, we reviewed relevant articles on current trends in scalp hair research that can be applicable to eyelashes, and the iatrogenic factors that can affect the lashes, such as cosmetics.

The general biology of the human lash

The human lower lid contains 75–80 lashes dispersed in three to four rows, whereas the upper lid has 90–160 lashes scattered on five to six rows.^{3,6,7} The anatomy of the lash and hair has some similar characteristics.⁸ Both have a hair shaft (the visible part) that extends outside the skin, a root that is under the skin and a bulb, which is the enlarged terminal portion (Fig. 1). The inferior portion of the bulb is in direct contact with the dermal papilla, which brings key mesenchymal-epithelial interactions in follicle cycling.

The lash itself is made up of three structures that fit into one another (Fig. 2).⁶ The innermost structure, the medulla, consists of loose cells. A thicker cortex surrounds the medulla to ensure its strength and stability. The pigmentation of either the lash or hair is the result of the melanin contained in the cortex. Finally, the cuticle, composed of several cell layers, forms the outermost portion, offering protection to the internal structures by its impermeability.

The anatomy and physiology of the lash follicle are distinctive from other hair follicles. Consequently, the lash follicle is worthy of a detailed study and appreciation of its specific characteristics and surrounding skin; its influence on the lash life cycle, curvature, and pigmentation; and the age-related changes of the lashes.

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