

Tarsal plate: Protective Structure Peculiar to Buzzard's (*Buteo buteo*) Palpebra Inferioris ^[1]

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Summary

The study was carried out to investigate the effects of some external egg traits on hatchability using classification tree mRapid increase in human population leads to frequent contact with wild animals. Recently, the number of wild animals brought to the clinic of Faculty of Veterinary Medicine increased in consequence of illegal hunting, injury and road accident. In the present study, 16 palpebra inferiores of 8 buzzards (*Buteo buteo*) were investigated by subgross and histological methods. Palpebra inferioris responsible of covering cornea was longer than superior palpebra and supported with a dense connective tissue structure called tarsal plate. Tarsal plate in the buzzard has a strong structure and suitable form to protect eye. This strong tarsal plate should be kept in mind during surgical approach of inferior palpebra.

Keywords: *Buzzard, Eyelid, Protective structure, Tarsal plate*

Tarsus palpebralis: Şahin (*Buteo buteo*) Alt Göz Kapağına Özgü Protektif Bir Yapı

Özet

İnsan nüfusundaki hızlı artış yaban hayvanları ile insan temasının artmasına yol açmaktadır. Son yıllarda genellikle yaban hayvanlarının yasal olmayan yollarla avlanması, yaralanması yada trafik kazası gibi vakaların hızla artması sonucu Veteriner Fakültesi kliniklerine gelen vakalar da artmıştır. Bu çalışmada 8 adet şahine (*Buteo buteo*) ait 16 palpebra inferioris, subgross ve histolojik yöntemler kullanılarak incelendi. Cornea'nın kapatılmasından sorumlu olan alt göz kapağı, üst göz kapağına göre daha uzundur ve kuvvetli bir bağ doku tabakası olan tarsal tabaka (tarsus palpebralis) ile desteklenmiştir. Şahin'in tarsal tabakası oldukça kuvvetli şekillenmiş, kornea'nın şekline uygun koruyucu bir yapıdır. Şahinde alt göz kapağının cerrahi uygulamalarında kuvvetli tarsal tabakanın varlığı göz önünde bulundurulmalıdır.

Anahtar sözcükler: *Göz kapağı, Protpektif, Şahin, Tarsus palpebralis*

INTRODUCTION

Avian eye has vital importance for feeding, reproduction and flying. Though eyeball is very big, its protection by orbital structure is relatively weak ¹. Eyeball is protected by inferior palpebra, superior palpebra and nictitating membrane from cranial traumas. Superior palpebra is short and thick while inferior palpebra, that is responsible for closing eye and cornea, is thinner, wider and mobile ². Eyelids of mammalian

and avian are covered inside by palpebral conjunctiva and outside by a thin skin. There is an intensive connective tissue called tarsal plate between dermis layer of skin and lamina propria in conjunctiva to support eyelid ³. Fibroelastic tarsal plate occurs very strongly in some avian species ⁴. Slonaker ⁵ introduced the presence of tarsal plate in inferior palpebra in the sparrow.



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The commonest eyeball lesion of wild avians, especially birds of prey is trauma. Common cases related to trauma are corneal ulcerations, hypema, traumatic uveitis, scleral bone fractures ¹. Transient adhesions such as tarsorafi are applied by bringing superior and inferior palpebra closer for treatment of corneal traumatic lesions ^{4,6}. Anatomical structure of eyelids should be known in detail for that kind of surgery. To our knowledge there is no information related to tarsal plate in the buzzard though there are numerous studies on the eye and accessory organs of both mammalian and avian. The aim of the present study was to investigate morphologic structure of tarsal plate and inferior palpebra of the buzzard which is a bird of prey living in both wildlife and cities.

MATERIAL and METHODS

A total of 16 palpebra inferiors belonging to 2 female and 6 male adult buzzards (*Buteo buteo*) brought to the Faculty of Veterinary Medicine, Department of Clinics because of gunshot were investigated. Samples were fixed in 10% neutral buffered formalin. Morphometry of tarsal plates were measured by Mitutoyo Digimatic Vernier Scale (150 mm) (code no: 500-311, Model CD-15D, serial no: 7175731, Mitutoyo Corporation, Japan). Samples taken for light microscopical examination were embedded in paraffin wax and then sectioned at 5 to 6 μ m thickness. The prepared sections were stained with Mallory's triple staining technique modified by Crossman, Heamotoxilen-Eosin (HE) and Safranin O. The photographs of inferior palpebra and tarsal plate were taken by Olympus C-5060 under Olympus SZ-61 TRC stereo-microscope and the photographs of histological samples were taken by Nikon Eclipse E600 microscope. The Nomina Anatomica Avium was employed for the anatomical nomenclature ⁷.

RESULTS

Tarsal plates were determined macroscopically under conjunctiva on inferior palpebra of both right and left eyes of all buzzards. Tarsal plate was concave and oval shaped conforming to the shape of cornea (Fig. 1). It was (n = 15) 11.00 ± 0.8 mm in width, 8.78 ± 0.81 mm in height and 0.84 ± 0.1 mm in thickness.

On the histological examination of HE staining it was observed that tarsal plate localized between conjunctiva and palpebral skin included highly dense meshwork of collagenous fiber and connective tissue cells with pink cytoplasm. These collagenous fibers forming tarsal plate were extremely dense and homogeneous without any

cavity. Collagenous fibers forming matrix were detected to consist of fibroblasts and various sized vessels. Above mentioned connective tissue cells were determined to be in blue color and various sized vessels were observed after triple staining (Fig. 2).

DISCUSSION

Inferior palpebra which is thin, wide and mobile is stated to be responsible for protection of eyeball ^{4,8}. Besides inferior palpebra consists of a fibroelastic tarsal plate that is variable in different species. Therefore, there are differences between the species related to

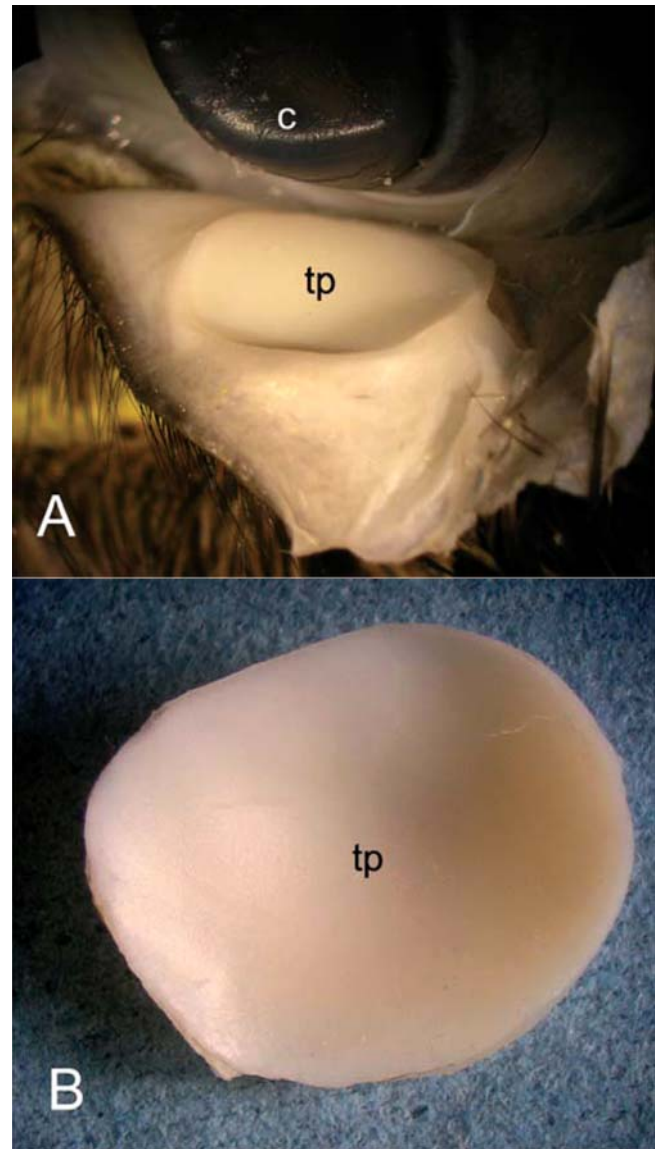


Fig 1. (A) Left eye of the buzzard with the lower lid dissected loose and turned down to show the tarsal plate (tp) and cornea (c). **(B)** Completely dissected tarsal plate (tp)

Şekil 1. (A) Tarsal tabaka (tp) ve cornea'yı (c) göstermek amacıyla şahin sol alt göz kapağı diseksiyonla ventral'e kıvrıldı. **(B)** Tamamen diseke edilmiş tarsal tabaka (tp)

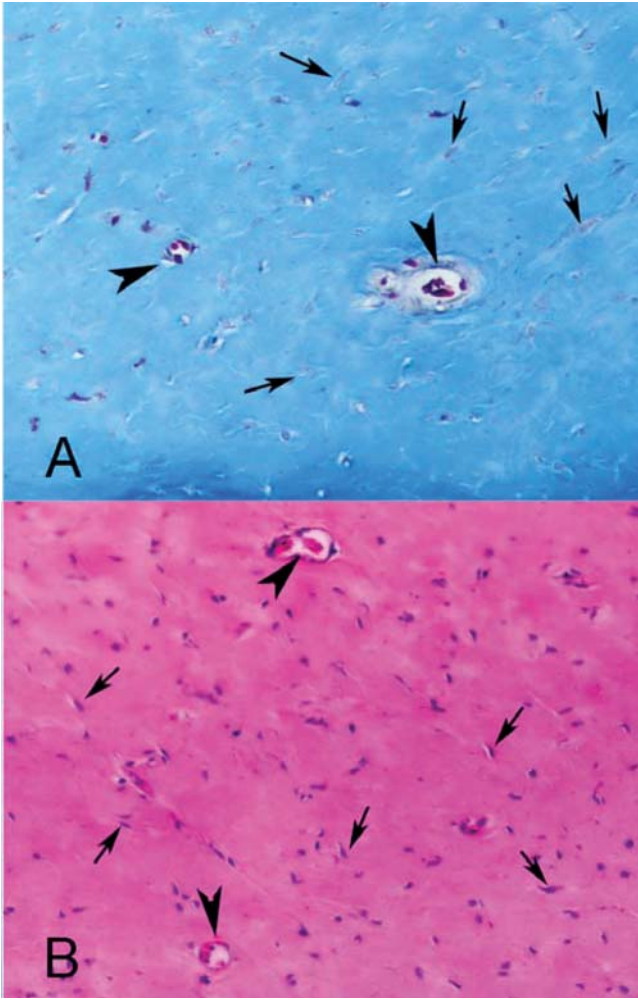


Fig 2. Photomicrograph illustrating histological features of tarsal plate in buzzard

Compact connective tissue contained dense collagenous fiber and fibroblasts (arrows) and vascular structures (**arrow heads**). **(A)** Mallory's triple staining x240. **(B)** Heamotoxylin-Eosin staining x240

Şekil 2. Şahinde tarsal tabakanın histolojik özellikleri

Yoğun kollagen lifler ve fibroblast (**ok**) ve damarsal yapılardan (**okbaşı**) oluşan sıkı bağ doku **(A)** Mallory'nin üçlü boyaması x240. **(B)** Hematoksilen-Eozin x240

development of a tough fibroelastic tarsal plate within the conjunctiva of the avian lower eyelid⁹. In the study, we observed a strong structure which led us to think that it might be effective to protect the eye of buzzard from external influences. This structure was seen macroscopically as an oval and concave shaped and cartilage-like structure under conjunctiva. However no chondrocyte and chondroblast were identified in this structure by histological examinations performed with both HE and triple staining. Also Safranin-O staining performed to determine the cartilage presence showed that the structure was not in cartilage nature. In all histological examinations, various sized vessels filled with erythrocytes, between intensive connective tissue

were detected. These findings proved that the structure was formed by compact connective tissue.

The first and most comprehensive study on avian eyeball and inferior palpebra was performed by Slonaker⁵ in the English Sparrow (*Passer domesticus*). Slonaker⁵ stated that there is a saucer shaped connective tissue mass in inferior palpebra and it is 2.43 mm in width, 1.98 mm in height and 0.073 - 0.099 mm in thickness. No cartilage cell was determined in the structure by Slonaker⁵. In our study, tarsal plate was identified as cartilage-like structure macroscopically but it did not included cartilage cell in the buzzard which is a raptor. It was detected that tarsal plate of buzzard was 4.5 times bigger and 10 times thicker than tarsal plate of English sparrow⁵. This finding is normal as buzzard is a bigger animal. On the other hand, thicker tarsal plate in the buzzard might provide an effective protection of cornea from both preys and environmental factors during hunting.

Domestic mammals^{3,10} and humans¹¹ have half-moon shaped strong fibrous tarsal plate supporting superior and inferior palpebra but in avians tarsal plate exists only in inferior palpebra between skin and conjunctiva¹². To our knowledge, this is the first detailed morphologic data on tarsal plate of buzzard though there are many literatures about tarsal plate in mammals and avians. However, Park and Gill⁴ explained a strong fibroelastic tarsal plate in inferior palpebra of certain avian species.

Traumatic lesions of eyeball in wild avians are common problems. These lesions are developed mostly bilaterally and in the anterior part of the eye^{1,13}. The fact that eyeball is relatively bigger in avians makes more protective structures are necessary. In the buzzard tarsal plate is better developed in inferior palpebra since it is longer and more mobile than superior palpebra. Tarsal plate was like a shield to protect cornea. This connective tissue was so concentrated that it seems like cartilage macroscopically. Thus tarsal plate play an important role in protecting cornea from particles during gliding towards its prey and also from traumas that prey will cause. Tarsal plate was concluded to be very effective as a protective structure of the buzzard eye despite Fowler and Cubas¹ stated that avian protective structure of eye was weak.

Temporary tarsorrhaphy is one of the common treatment approaches in avian eyeball lesions^{4,14}. Congenital palpebral anomalies are also treated with surgical methods¹⁵. Strong tarsal plate of buzzard must be taken into account when performing surgery on inferior palpebra such as tarsorrhaphy.

In conclusion, a strong tarsal plate including intensive connective tissue was identified in the buzzard.

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