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Functional Forms of The Muscle Bundles Belong to External Eye Muscles in Human and Sheep

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Summary: The superior (dorsal), lateral and medial rectus muscles from 5 adult humans and Kıvırcık sheeps were included in the study. Transversal sections of 5 micrometers in thickness from the venteria (middles) of the muscles embedded in paraffin were prepared by rutin method and examined under stereomicroscope at 4x2x10 magnification.

The primary, secondary and tertiary fibre bundles from all of the muscles except the medial rectus muscle of human were obviously observed in the sections.

The biggest and the smallest muscle fibres were determined in the lateral rectus muscle of sheep and the superior rectus muscle of humans respectively.

The muscle fibres in primary bundles were found to be much intensive in sheep eye muscles compared with those of humans.

Consequently, despite to less number of fibres in muscle bundles, connective tissue between the bundles was seen much more abundantly in humans who have more eye movements compared with those of sheep.

Key Words: Human, sheep, external eye muscle, muscle fibre

İnsan ve Koyun Dış Göz Kaslanma Ait Kas Lifi Demetlerinin Fonksiyonel Biçimlenmesi

Özet: Çalışmada erişkin yaşta 5 insan ve 5 Kıvırcık koyuna ait göz kaslarından m. rectus bulbi dorsalis (superior), m. rectus bulbi lateralis ve m. rectus bulbi medialis'ler kullanıldı. Adı geçen kasların venter'lerinden yapılan transversal kesitler parafinde bloklandı. Takiben 5 mikrometre kalınlığındaki kesitler, stereo diseksiyon mikroskobunda 4x2x10 büyütmede incelendi.

Yapılan incelemede, insandaki m. rectus bulbi medialis dışındaki diğer tüm kaslardan alınan kesitlerde primer, sekunder ve tersier demet oluşumları belirgin şekilde gözlendi.

Kas lifi büyüklüğü itibariyle, en büyük kas lifinin koyunda m. rectus bulbi lateralis'de, en küçük kas lifinin ise insanın m. rectus bulbi dorsalis'inde olduğu saptandı.

Primer demetlerdeki kas lifi yoğunluğunun, koyun göz kaslarında insan göz kaslarına göre daha fazla olduğu gözlendi.

Sonuç olarak göz yuvarlağının daha hareketli olduğu insanda demetlerdeki kas lifi sayısı koyuna göre daha az, ancak demetler arası bağ dokusunun daha fazla olduğu gözlendi.

Anahtar Sözcükler: İnsan, koyun, dış göz kası, kas lifi

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Introduction

Eyes constitute the most important part of the structure which puts in order to reaction that adapts the inner and outer differences by collecting lots of knowledge about environments of the livings[15]. To be able to see the objects with one or two eyes, several eye muscles work in both sides. Several striated muscles have to work in the same time and in a hand collaboration in order to form the seeing event in a suitable way[14]. In human body fovea centralis in the center of macula which is near the posterior pole of the eyeball[14,17] and in animals, area centralis rotunda is the best area that takes light and picture. There is a different formation at the name of area centralis striaeformis that benefits monoculer seeing in animals[17]. Tractus opticus presents neurits that come from each two eyes courses the objects to be seen at the same time and single by each of two eyes. In order to see binocular both two eyes have to be in front of the head and be able to look at the same direction[14].

Bulbus oculi takes place at the side of the head in ruminants and equides and take places at rostrolateral in carnivores[6,7,10,17]. In humans it takes places on the face and at both sides of the nose belt[7,14,17].

Bulbus oculi settle down in a fat pillow at eye hole with a group of muscles. From these muscles dorsal rectus muscle and inferior rectus muscle cause to be turned the eye sphere around the horisontal axis while medial and lateral rectus muscles are turning around the vertical axis[9,10,14].

External muscles of the eyes, because of their morphologic pecularities, take place in the group of striated muscles, meanwhile, seperate from the other striated muscles by being sensitive to the medicines of choline curare group. Additionally it is a characteristic for eye muscles to have lots of nerve fibre for each muscle fibre[2,10]. Muscle fibres of the skeletal muscles that can be stretched are muscle cells which don't make anastomose with each other and make independent function from each other[4,8,16]. Muscle fibres constitute the groups which named primer bundle by coming together. Fibres at each primer bundles are surrounded by a connective tissue which is named as endomysium. Primary bundles by coming together constitute secondary and tertiary bundles which are surrounded by a greater quantity of connective tissues named as perimysium. The external sheat about the entire muscle is the epimysium[4,5,7,8,10,11,13,15,18]. The connective tissue organize the cooperation in function which is described above obtains function coorperation by tying_fibres and fibre bundles to each other[8]. At the same time fibres are protected against seperation and pressure by connective tissue[13]. The connective tissue constitue application of the attraction power to be created of the stretched muscle in a usefel situation[9]. The structure of a muscle is determined with the bigness of bundles[3]. The muscles whose have strong attraction have got bigger bundle and fibres but the number of fibres of them are less[5,12]. The bundles are big where action is big and powerfull[3,18]. In tinner muscles likes eye muscles the bundles are small[3].

Muscles functions depend on the amount of connective tissues which holds the fibres together and tie them to skeleton[13]. Perimysium shows more variability than endomysium in the same sort of animals which have got different habit[1]. There are differences between normal and a high degree antrena muscle. In antrena muscle, there are much more connective tissue[18]. External eye muscles are striated muscles with their morphologically and phisyologically pecularities and have an important role at eye movements.

Detailed information about the macroscopical and miscroscopical features of muscle fibers and bundles can be found in the literature[4,5,8,10,11,12,13,18]. However, there is no information about the formation and function of muscle fibers and bundles of the external eye muscles in human and sheep.

This study is carried out by purpose to show functional effects of the muscles bundles in the defects of the eyeball movement.

Material and Method

In this study 5 adult humans and 5 Kıvırcık sheeps were used. Dorsal, lateral and medial rectus muscles were removed according to general dissection rules. These muscle were fixed in 10 % formalin solution and afterwards transversal sections were taken from the ventral parts of these muscles and were embedded in paraffin. Five microns thick sections were made and stained with Hematoxylin- Eosin. Sections were examined with stereomicroscope at 4x2x10 magnification.

Results

Following results have been observed at the examination of the muscles fibres forming the dorsal, lateral and medial rectus muscles in human and sheep at 4x2x10 magnification.

The primary, secondary and tertiary fibre bundles from all of the muscles except the medial rectus of human were obviously observed in the sections (figure-1).

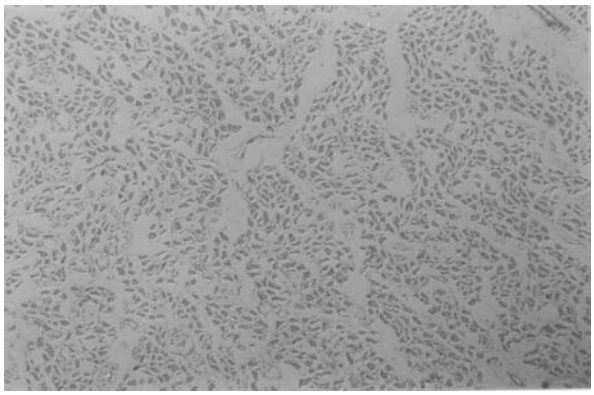

Figure: 1
View of the transversal section of the medial rectus bulbi muscle in the human (4x2x10).

The biggest muscular fibre was seen in lateral rectus muscle of sheep (figure-2), while the smallest muscular fibre was observed in dorsal rectus muscle of human (figure-3).

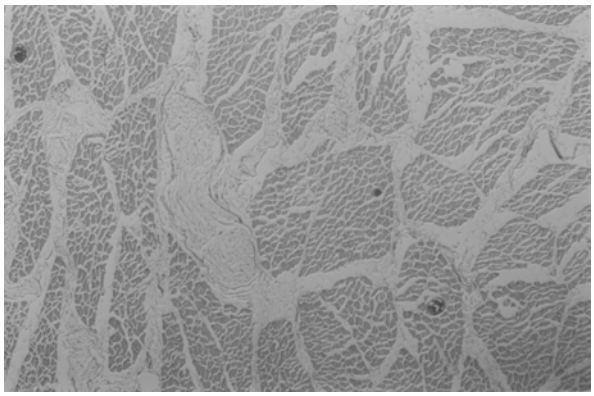

Figure: 2
View of the transversal section of the lateral rectus bulbi muscle in the sheep (4x2x10).

It was observed that the intensity of the muscle fibres in sheep eye is greater than those of human eye muscle (figure-2, 4, 6). Furthermore, the density of endomysium was found to be lower in the sheep eye muscle which have large number of muscle fibres.

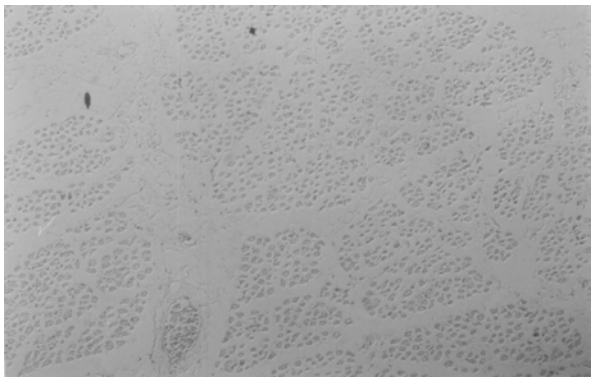

Figure: 3
View of the transversal section of the superior rectus bulbi muscle in the human (4x2x10).

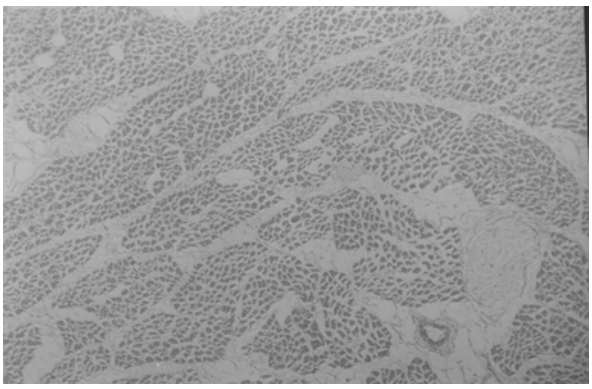

Figure 4:
View of the transversal section of the medial rectus bulbi muscle in the sheep (4x2x10).

In terms of degree of the density of the muscle fibres in each primary muscular bundles the sequence was medial, dorsal and lateral rectus muscle in sheep (figure-2, 4, 6) and lateral, medial and dorsal rectus muscle in human (figure-1, 3, 5).

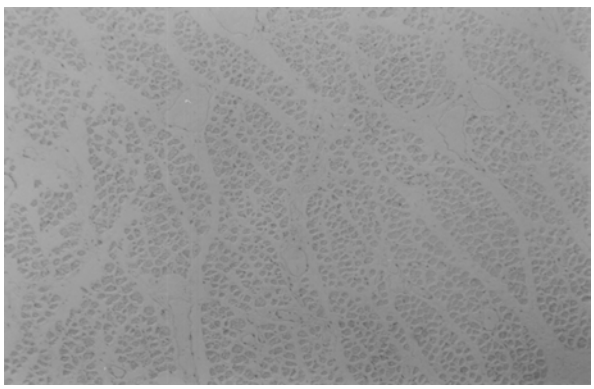

Figure 5:
View of the transversal section of the lateral rectus bulbi muscle in the human (4x2x10)

Addition to the above mentioned findings, the density of the fat tissues between the muscular bundles in sheep was observed to be greater than those of the human.

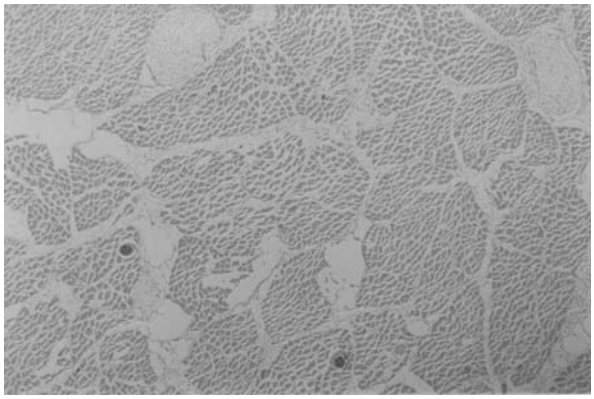

Figure 6:
View of the transversal section of the dorsal rectus bulbi muscle in the sheep (4x2x10)

Discussion

Epimisium, which covers the skeletal muscles, sends branches into the muscles which cover the primary, secondary and tertiary bundles as perimisium. Each muscle fiber in the primary bundle is covered by endomisium[3,5,7,8,10,11,13,18]. The formation of primary, secondary and tertiary bundles were observed in all muscles except the dorsal rectus muscle in human in this study.

The connective tissue which is found between the bundles and muscle fibers has a protective function for the muscles against pressure and distortion[13] besides providing a functional unit[8]. The beneficial usage of the power which is produced as a result of the muscle contraction is provided by the connective tissue[9]. Our observation on the presence of connective tissue among muscle fibers supports the ability of primary bundles to produce power independently as reported in the literature previously. Our findings are also parallel to those which show that bundle and muscle fibers are big in muscles with a high contraction potential[5,12] and small in tinner muscles like those of the eye[3].

Within the same species, perimysial connective tissue can show different structures according to different movement types[1]. A muscle with a higher movement rate than that of an ordinary muscle contains more connective tissue[9]. In this study, the presence of higher amounts of connective tissue was observed between the muscle bundles in human eye muscles when compared to those of sheep.

As a conclusion, the main difference between human and sheep eye muscles was found in the density of the muscle fibers and the amount of connective tissue between bundles.

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