Zagazig Veterinary Journal, ©Faculty of Veterinary Medicine,
Zagazig University, 44511, Egypt.
Volume 52, Number 1, p88-103 March 2024
DOI: 10.21608/zvjz.2024.257542.1227

RESEARCH ARTICLE

Blended Education Through On-Line Computer Program During Crises Demonstrating the Extraocular Muscles of Goat's Eye

Eman A. A. Mahdy[1*], Ali El-Deen Abdul Basset[1], Esraa B. Gad[1*], Mustafa Abd El-Raouf[2], and Mervat M. H. Konsowa[1]

1Anatomy and Embryology Department, Faculty of Veterinary Medicine, Zagazig University 44511, Zagazig, Egypt.

[2]Department of Surgery, Anesthesiology, and Radiology, Faculty of Veterinary Medicine, Zagazig University 44511, Zagazig, Egypt.

Corresponding authors e-mail: dr.emanmahdy82@gmail.com; esraabarakat211@gmail.com

Abstract

There were six E-Learning categories including E-Learning without existence and E-communication (self-learning), E-Learning with personal attendance but lacked E-communication, E-Learning without attendance and with E-communication, E-Learning with online existence and E-communication, E-Learning with intermittent attendance and E-communication and E-Learning with existence and E-communication. The pandemic crisis had abruptly altered ophthalmology education, leading to the creation of innovative online curricula. For demonstration the extraocular muscles of goat, two alive healthy adult female goats were subjected for computed tomography (CT) and five goat's head were kept in formalin 10% then dissected carefully. CT was courteous for imaging the different structures of the eye; eyeball and its adnexa especially extraocular muscles. Moreover, for evaluation the postponement of the disease outside the eyeball toward the orbital cavity and brain. The extraocular muscles fixed the eyeball in the orbital cavity which controls movement of the eye. There were four recti muscles; dorsal, ventral, lateral and medial and the two oblique muscles; dorsal and ventral, in addition to the retractor oculi (bulbi) muscle. The four recti muscles controlled the motility of the eyeball according to their position. The dorsal oblique muscle moved the dorsal part of the eyeball ventrally and medially. While the ventral oblique one rotated the eyeball dorsally and medially. Additionally, the retractor oculi muscle acts to withdraw the eyeball. Finally, studying muscular anatomy and movement was considered one of the most important medical scientific studies, which in turn helped surgeons in treating strabismus cases, especially in humans. The undergraduate students and postgraduates preferred blended learning rather than traditional learning methods.

Keywords: Blended teaching, Eye, Goat, Online learning, Computed tomography, and Extraocular muscles.

Introduction

The world has rapidly transitioned from in-person to online learning. Through this abrupt shift, lecturers encountered several difficulties; including those related to time, financing, technical knowledge, and strategic planning, even in advanced countries [1,2]. Online learning could be utilized as an additional teaching tool in addition to traditional classroom instruction, but it couldn't completely replace in-person anatomy teaching. On the other hand, group online learning exercises with 3-D software and dissection videos were recommended [3].

There were several challenges through the past years that encountered ophthalmology graduate medical education, and then in 2020 everything changed. However, due to the severe

acute lung condition following the global disruption of the coronavirus pandemic in medical education, ophthalmic educators quickly changed their curricula to incorporate advanced and successful virtual learning modes [4]. One of the most significant farm animal species was the goat, which was recently used as an experimental animal. Both industrialized and developing nations have seen a rise in demand for goat products in recent times [5-7]. The soft tissues of small ruminant eyes were more like human eyes in terms of scleral rigidity, muscle elasticity, width, thickness, and implantation onto the sclera. Consequently, prior to conducting the operation on human eyes, rectus muscle recession, amputation, and plication procedures could be repeated on small animal eyes to enhance a person's orientation and practical experience [8].

Cross-sectional imaging of the eye was regularly attained as a helpful tool for medical ophthalmologic inspection. Computed tomography (CT) had greater three-dimensional resolution, assisted by the normal difference (contrast) between soft tissues, bone, fat, and air. Also, CT is considered the most important means for assessing traumatic injuries and imagining foreign bodies [9].

In humans, the use of thin sections with multiplanar scanning (axial, coronal, and sagittal planes) and the possibility of three-dimensional reconstruction permitted thorough evaluation. The diagnostic result was optimal when the radiologist and ophthalmologist collaborated in the radio-diagnostic work. The extraocular muscles were well visible on CT and passed parallel to the orbital wall [10].

The muscles essential to the function of the eye were formed from three groups: the extrinsic, intrinsic, and palpebral muscles. The intrinsic muscles controlled the pupillary width and the contour of the lens. The palpebral muscle group included the muscles of the lid and the muscles of the head, which controlled the position and shape of the palpebral slit. The extrinsic muscles of the eyeball were responsible for the rotation of the eyeball; they rotate the eyeball around three vertical axes. This group includes the dorsal, ventral, medial, and lateral straight muscles, the dorsal and ventral oblique muscles, and the retractor muscle of the eyeball. The four straight muscles were termed according to their insertion on the eyeball [11].

Several studies discussed the extraocular muscles in different domestic animals [11-17]. The purpose of the current work was to formulate an educational module for the extraocular muscles in goats to be used in virtual anatomy learning.

Material and Methods

Animals

The present study was performed on five goat's head of both sexes, and two alive adult apparently healthy female Baladi goats, aging from one to two years old and weighing 35.33±1.25 Kg. The head specimens were collected from the Zagazig abattoir, and the animals were obtained from the farm at the Faculty of Veterinary Medicine, Zagazig University. Animals were handled along with Institutional Animal Care and Use Committee (IACUC), Zagazig University (ZU-IACUC/2/F/236/2023), Egypt.

Computed tomography (CT)

The computed tomography was made in Bayan center in Belbis–Sharkia. For imaging the ocular structures of the goat's eye, axial, coronal and sagittal sections of two adult apparently healthy female goats were obtained using CT scan (GE multi-slice machine) with 120 KV, 120 MA and 0.3 mm slice thickness. Before CT scanning, food and water were restricted

for 24, 12 h, respectively. For good securing and positioning during scanning, the animals were sedated by intravenous injection of xylazine HCL 2% (Xyla-ject, ADWIA Pharmaceuticals Co., 10th of Ramadan City, Egypt) at a dose rate of 0.2 mg/kg body weight [18]. The images were processed using built-in CT software for obtaining three-dimensional images.

Extraocular muscles of the goat: Gross anatomy

Five goat's heads were thoroughly washed with normal saline and injected with 10% formalin solution through the common carotid artery. Then, the head specimens were kept in 10% formalin solution for three week. After that, the eyes were carefully dissected to demonstrate the extrinsic muscles of eyeball. The ocular muscles were detected and digitally photographed with a camera (32 megapixels, Sony DSC-W690). Then, the specimens were kept in the museum of our department for insight learning.

Extraocular muscles of the goat: Gross anatomy

The Adobe flash player version 32 described the muscles of goat's eye which contained labeled images. For more convenience of the manipulator, two buttons found on the left upper of the screen to allow the user to move progressing to the home page or retrograde to a previous page. Two arrows found on the bottom left of the screen to permit the manipulator to move forward to the next photo or backward to the previous one. The user moved the pointed arrow through the keyboard over the different part of the image. When the arrow passed by a labeled structure, the name of this structure appeared on the image. The Adobe flash player program was uploaded to the following website:

https://sites.google.com/view/goat-anatomy

Survey and Statistical analysis

The first survey of undergraduate students

One hundred veterinary medical third-year students of Zagazig University in the Anatomy Department contributed to the descriptive survey for this study.

The second survey of the postgraduates

Twenty different demonstrators, assistant lecturers, lecturers, and assistant professors from the Faculty of Veterinary Medicine at Zagazig University were incorporated into this survey.

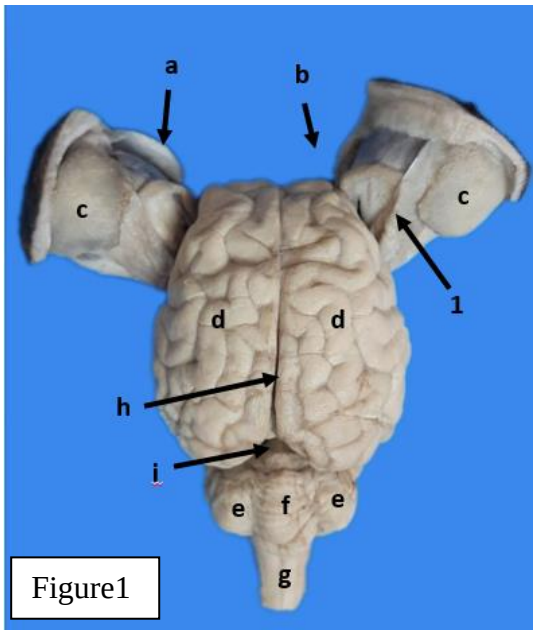
The acquired data was subjected to analysis using R 4.1.0 software (R Foundation for Statistical Computing, Vienna, Austria). One-sample z-test for proportion to test the statistical difference between the undergraduate and the postgraduate students who recommend or not recommend using blended learning as a different type of teaching. This test was selected due to the qualitative natural of dependent variable, which involved classifying responses as either recommending or not recommending self-directed learning. A significance level was set at $P< 0.05$.

Results

Extraocular muscles of goat's eye

The extraocular muscles hung up the eyeball in the orbital cavity and were considered the cause of motility of the eye. There were four recti muscles: the lateral, medial, dorsal, and ventral. They originated from the apex of orbit and inserted posterior to the limbus specifically at sclera, they changed the movement of the eye according to their names. The dorsal oblique arose from the medial aspect of the orbital apex, which moved dorsomedially before passing through a trochlea close to the medial canthus. After that, it made a sharp turn and passed dorsolaterally to the globe. It

moves the dorsal part of the eyeball ventrally and medially. The ventral (inferior) oblique originated from the anteriolateral aspect of the palatine bone on the medial part of orbital wall and moved underneath the eye, overpassing the tendon of ventral rectus. The ventral oblique moves the eyeball dorsally and medially. The retractor oculi (bulbi) muscle arose from the orbital apex and moved forward to make a cone circumscribed the optic nerve and entering posterior and deep to the recti muscles. This muscle bundle works to withdraw the eyeball toward the orbit **(Figures 1- 4)**.



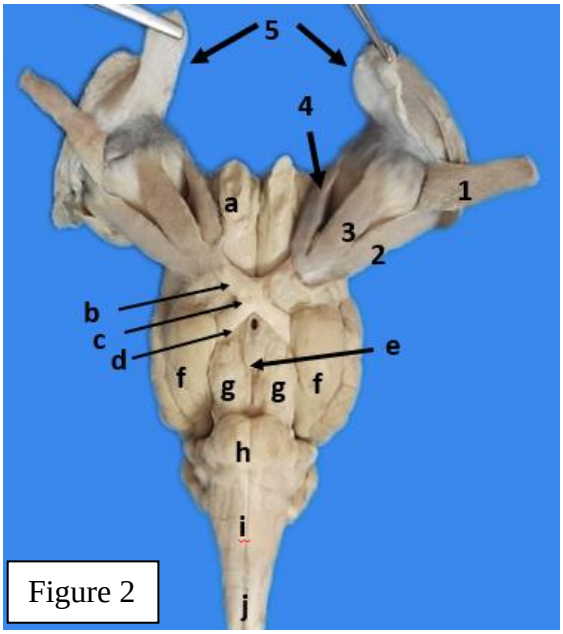
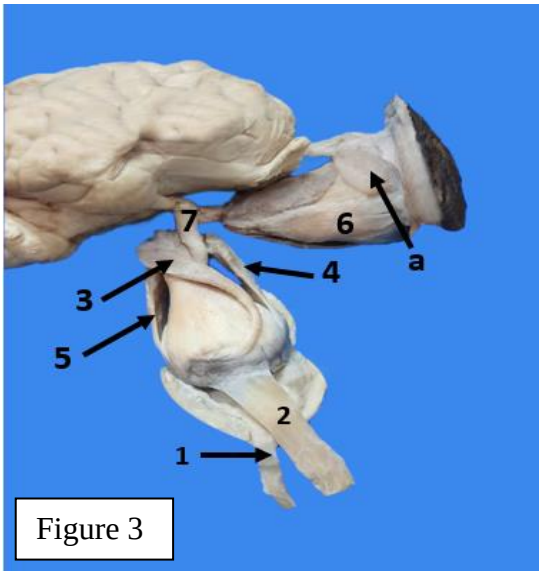


Figure 1: A photomacrograph of the eye and brain of goat (dorsal view) showing, 1- M. Levator palpebrae superioris, a. Left eye, b. Right eye, c. Lacrimal gland, d. Two cerebral hemispheres, e. Two cerebellar hemispheres, f. Vermis cerebelli, g. Spinal cord, h. Longitudinal fissure, and i. Transverse fissure.

Figure 2: A photomacrograph of eye and brain of goat (ventral view) showing, 1- M. obliquus ventralis (reflected), 2- M. rectus lateralis, 3- M. rectus ventralis, 4- M. rectus medialis, 5- Cartilaginous part of third eyelid, a. Olfactory Bulb, b. Optic nerve, c. Optic chiasma, d. Optic tract, e. Mammillary body, f. Piriform lobe, g. Cerebral

Peduncles, h. Pons, I. Medulla oblongata, and j. Spinal cord.



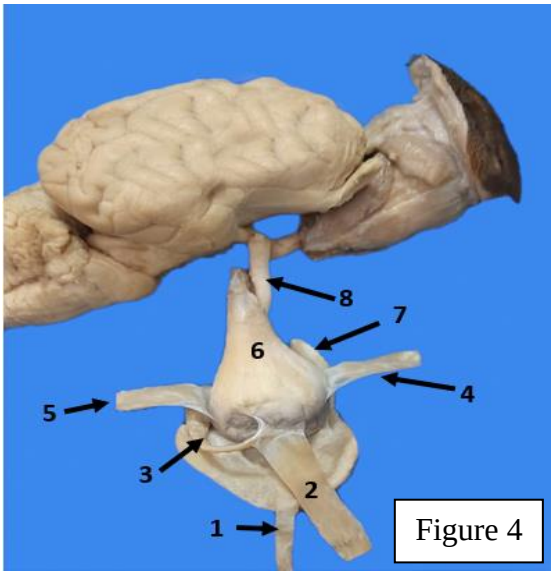


Figure 3: A photomacrograph of right goat's eye (dorsal view) and left eye (medial view) connected with brain showing, a. Cartilaginous part of third eyelid of left eye, 1- M. Levator palpebrae superioris (reflected), 2- M. rectus dorsalis (reflected), 3- M. obliquus dorsalis, 4- M. rectus medialis, 5- M. Lateral rectus, 6. Medial rectus muscle of left eye, and 7- Optic nerve.

Figure 4: A photomacrograph of right goat's eye (dorsal view) connected with brain after reflection of M. Levator palpebrae superioris (1), M. rectus dorsalis (2), M. obliquus dorsalis (3), M. rectus medialis (4) and M. rectus lateralis (5) showing, 6- M. retractor bulbi, 7- Cartilaginous part of third eyelid, and 8- Optic nerve.

Table (1): Origin, insertion, and action of extraocular muscles of the goat's eyeball

Muscle	Origin	Insertion	Action
Dorsal rectus	Arose from the apex of the orbit	Inserted posterior to the limbus specially at the sclera	Moves the eyeball upward. (elevate globe)
Ventral rectus			Moves the eyeball downward. (depress globe)
Medial rectus			Moves the eyeball medially
Lateral rectus			Moves the eyeball laterally
Dorsal oblique	Originated from medial aspect of orbital apex	Reached the trochlea close to the medial canthus	Moves the dorsal portion of eyeball ventrally and medially (Rotate12 O'clock medially)
Ventral oblique	Arose from the anteriolateral aspect of the palatine bone on the medial part of orbital wall	Moved underneath the eye, overpassing the tendon of ventral rectus.	Moves the ventral portion of eyeball dorsally and medially (Rotate12 O'clock laterally)
Retractor oculi	Arose from the orbital apex	Entered posterior and deep to the recti muscles	Withdraws the eyeball (Retract globe).

Computed tomography (CT)

On axial scan, the lateral and medial recti muscles were seen, but the ventral rectus muscle incompletely viewed. The latter muscle was clearly seen on sagittal scan. The dorsal rectus muscle was seen as a single soft tissue shadow via sagittal scan accompanied with levator palpebrae superioris muscle. The dorsal oblique

muscle was ideal seen on the coronal scan passing dorsally to the dorsal rectus muscle, however, could also be seen on the upper axial views as it ran through the trochlea. The ventral oblique was the minor distinct muscle on CT scan, only the insertion was irregularly appeared on axial scan. The lacrimal gland appeared well on axial and coronal scans. The lens was seen as a small white shadow on coronal scan and white circle on axial scan. On axial scan, the optic nerve and optic foramen were well visualized, and the optic papilla was seen **(Figures 5-8)**.

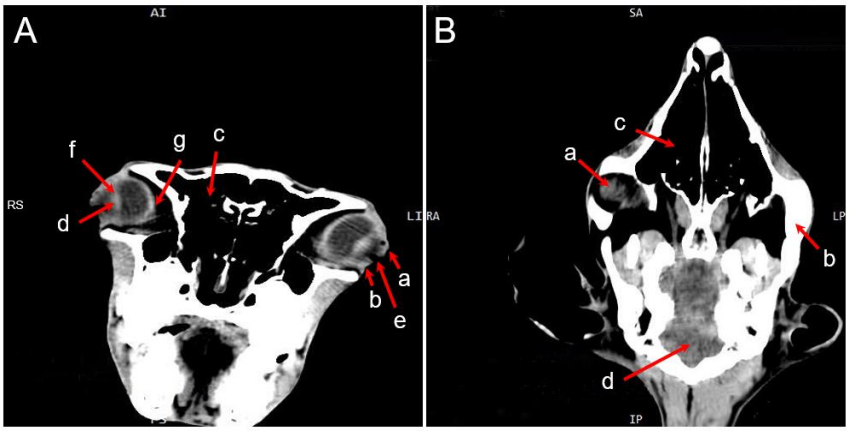


Figure 5: (A) Anterior coronal scan of soft tissue mass occupying the orbital cavity showing, a. Upper eyelid, b. Lower eyelid, c. Nasal cavity, d. Lens, e. palpebral fissure, f. ciliary body and iris and g. Sclera, retina and choroid complex. (B) Axial scan of the left eye for soft tissue mass occupying the entire superolateral orbit showing, a. Lacrimal gland, b. Supraorbital process and C. Nasal cavity, d. Bain.

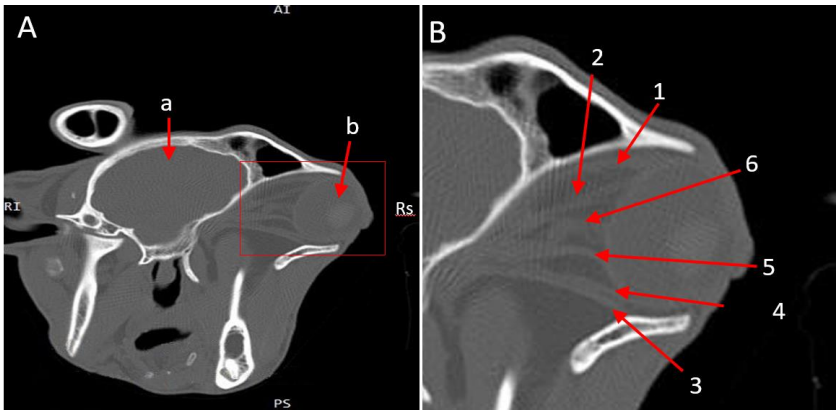


Figure 6: (A) Soft tissue window of CT scan with Sagittal plane of left eye showing, a. Brain, b. Left eye. (B) A higher magnification of left eye of goat in soft tissue window of CT scan with Sagittal plane showing, 1- M. Levator palpebrae superioris, 2- M. rectus dorsalis, 3- M. obliquus ventralis, 4- M. rectus ventralis, 5- M. rectus lateralis and 6- M. rectus medialis.

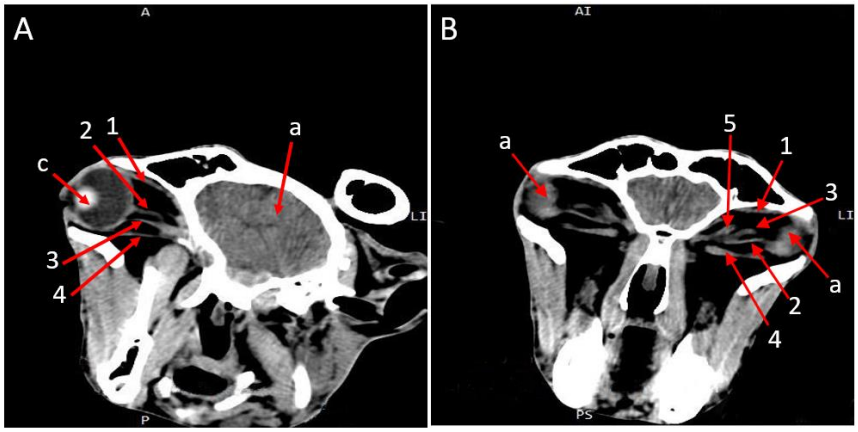


Figure 7: (A) Bony window of CT scan with Sagittal plane of right eye showing, a. Brain, c. Lens, 1- M. Levator palpebrae superioris, 2- M. rectus medialis, 3- M. rectus lateralis and 4- M. rectus ventralis. (B) Non contrast CT scan with coronal plane of right and left eye showing, a. Lacrimal gland, 1- M. Levator palpebrae superioris, 2- M. rectus medialis, 3- M. obliquus dorsalis, 4- M. rectus ventralis and 5- M. rectus dorsalis.

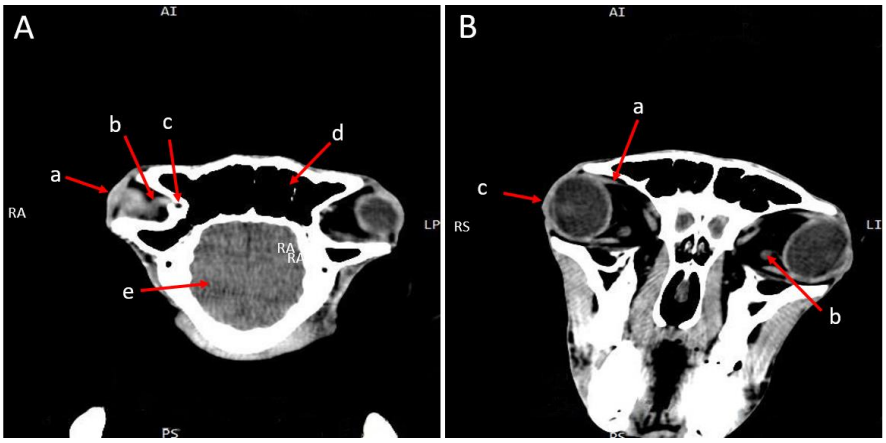


Figure 8: (A) Axial computed tomogram of right and left eye showing the entire optic nerve and its entry into the optic foramen, a. Cornea, b. Optic nerve, c. Optic foramen, d. Nasal cavity, e. Brain. (B) Coronal computed tomogram showing, a. M. Levator palpebrae superioris, b. Optic papilla, c. Cornea.

E-Learning module and Computer program for teaching the extra-ocular muscles of goat's eye

There were variations in images of formalized goat's eye and related ocular muscles on our website. The Adobe flash player (version 32) described the muscles of goat's eye which contained labeled images. It had a home page which contained the title of the article and the authors. In addition to list of buttons through which the user could move to the different parts inside the program **(Figure 9)**.

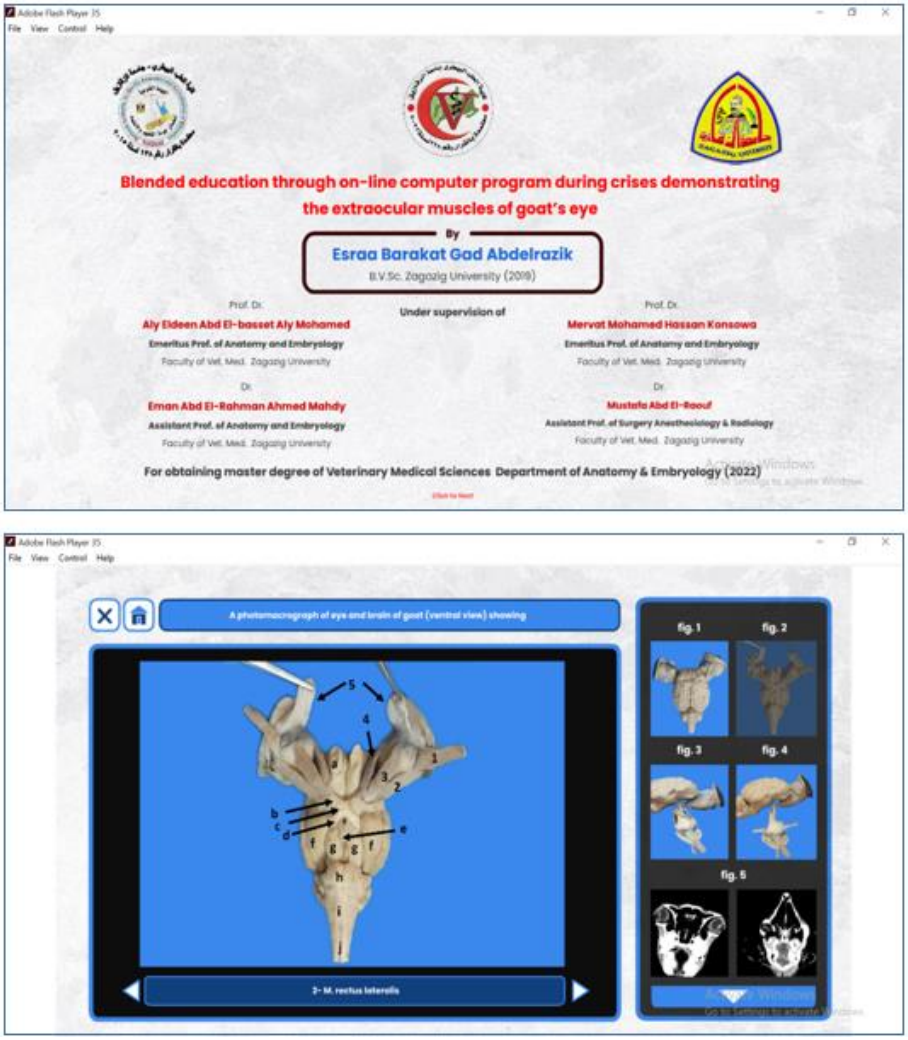


Figure 9: Adobe flash player version 32 described the extraocular muscles of goat's eye which include labeled images. It had a home page contained the title of article and the authors. In addition to list of buttons through which the user could move to the different parts inside the program.

Instructions

• During the course, the students must make a visit to the lab in the dissecting room.

• The prepared samples must be studied in the department museum.

• The students should communicate with the course instructor and don't hesitate to ask him/her whether directly face to face or by any source of available contacts.

Learning Objectives

At the end of this module the student was accomplished to:

• Describe the ocular muscles of goat.

• Self-evaluation.

Contents

1.The different images of formalized goat's eye and related ocular muscles via (Adobe flash player version 32) were found on our website.

2**.** Learners must visit the department museum to study the preserved specimens.

Survey and Statistical analysis

The first survey of undergraduate students

The results of our investigation questionnaire made on students of third year students showed that During demonstration of the data of aspects of comparison of the survey obtained from third year students, found that, independence, had a percentage of agreement 15% much better, 50% better and 35% the same as traditional methods. Concerning the creation and motivation point of comparison, explained a percentage of agreement 36% much better, 50% better and 14% the same as traditional. The results in communication skills revealed that, the percentage of agreement was 20% much better, 55% better and 25% the same as traditional methods. Regarding the teamwork and interesting comparison point Chart, proved a percentage of agreement 20% much better, 32% better and 48% the same as traditional methods.

Our observation showed that proficiency and efficiency point, the percentage of agreement 33% much better, 58% better and 9% the same as traditional methods. The interpretation of permanent reference point exhibited a percentage of agreement 80% much better, 15% better and 5% the same as traditional methods. In case of availability and comfortability comparison point result showed a percentage of agreement 75% much better, 20% better and 5% the same as traditional methods. The extent of time-consuming point showed that, a percentage of agreement 30% much better, 60% better and 10% the same as traditional methods. Examining opinion about problem solving abilities proved that the percentage of agreement 45% much better, 35% better and 20% the same as traditional methods. However, the integration point Chart revealed a percentage of agreement 70% much better, 25% better and 5% the same as traditional methods **Table 2 and Figure 10A.**

The results of this survey revealedthat 95% of students recommended online learning, while 5% did not recommend its use.

Table (2): The results of research questionnaire carried out on 100 third-year undergraduate students.

Item	Count	Points of result			Total
	%	The same	Better	Much better	
Independence	Count	35	50	15	100
	%	35%	50%	15%	100.00%
Creation &Motivation	Count	14	50	36	100
	%	14%	50%	36%	100.00%
Communication Skills	Count	25	55	20	100
	%	25%	55%	20%	100.00%

Teamwork &Interesting	Count	48	32	20	100
	%	48%	32%	20%	100.00%
Proficiency & Efficiency	Count	9	58	33	100
	%	9%	58%	33%	100.00%
Permanent reference	Count	5	15	80	100
	%	5%	15%	80%	100.00%
Availability &comfortability	Count	5	20	75	100
	%	5%	20%	75%	100.00%
Time Consuming	Count	10	60	30	100
	%	10%	60%	30%	100.00%
Problem Solving abilities	Count	20	35	45	100
	%	20%	35%	45%	100.00%
Integration	Count	5	25	70	100
	%	5%	25%	70%	100.00%

The second survey of postgraduates

The outcomes of our investigation questionnaire were made on the demonstrators, assistant lecturers, lectures, and assistant professors in Faculty of Veterinary Medicine, Zagazig University. During demonstration of the data of aspects of comparison of the survey obtained from postgraduates, found that, independence, had a percentage of agreement 40% much better, 45% better and 15% the same as traditional methods. Concerning the creation and motivation point of comparison explained a percentage of agreement 30% much better, 35% better, and 35% the same as traditional. The results in communication skills revealed that the percentage of agreement was 30% much better, 25% better and 45% the same as traditional methods. The teamwork and interesting comparison point proved a percentage of agreement 15% much better, 35% better and 50% the same as traditional methods.

Our observation showed that, proficiency and efficiency point, the percentage of agreement 45% much better, 35% better, and 20% the same as traditional methods. The interpretation of permanent reference point exhibited a percentage of agreement 30% much better, 45% better and 25% the same as traditional methods. In case of availability and comfortability comparison point results showed a percentage of agreement 60% much better, 20% better and 20% the same as traditional methods. The extent of time-consuming point showed that, a percentage of agreement 35% much better, 55% better and 10% the same as traditional methods. Examining opinion about problem solving abilities proved that the percentage of agreement 35% much better, 35% better and 20% the same as traditional methods. However, integration point revealed a percentage of

agreement 30% much better, 55% better and 15% the same as traditional methods (**Table 3** and **Figure 10 B)**.

The results of this survey revealedthat 13% of postgraduate students recommended online learning,while 7% did not recommend its use. Undergraduate and postgraduate students preferred the blended learning rather than traditional learning methods (P<0.001 and P=0.02) respectively.

Table (3): The results of research questionnaire carried out on 100 postgraduate students

Item	Count	Points of result			Total
	%	The same	Better	Much better	
Independence	Count	3	9	8	20
	%	15%	45%	40%	100.00%
Creation &Motivation	Count	7	7	6	20
	%	35%	35%	30%	100.00%
Communication Skills	Count	9	5	6	20
	%	45%	25%	30%	100.00%
Teamwork &Interesting	Count	10	7	3	20
	%	50%	35%	15%	100.00%
Proficiency & Efficiency	Count	4	7	9	20
	%	20%	35%	45%	100.00%
Permanent reference	Count	5	9	6	20
	%	25%	45%	30%	100.00%
Availability &comfortability	Count	4	4	12	20
	%	20%	20%	60%	100.00%
Time Consuming	Count	2	11	7	20
	%	10%	55%	35%	100.00%
Problem Solving abilities	Count	4	9	7	20
	%	20%	45%	35%	100.00%
Integration	Count	3	11	6	20
	%	15%	55%	30%	100.00%

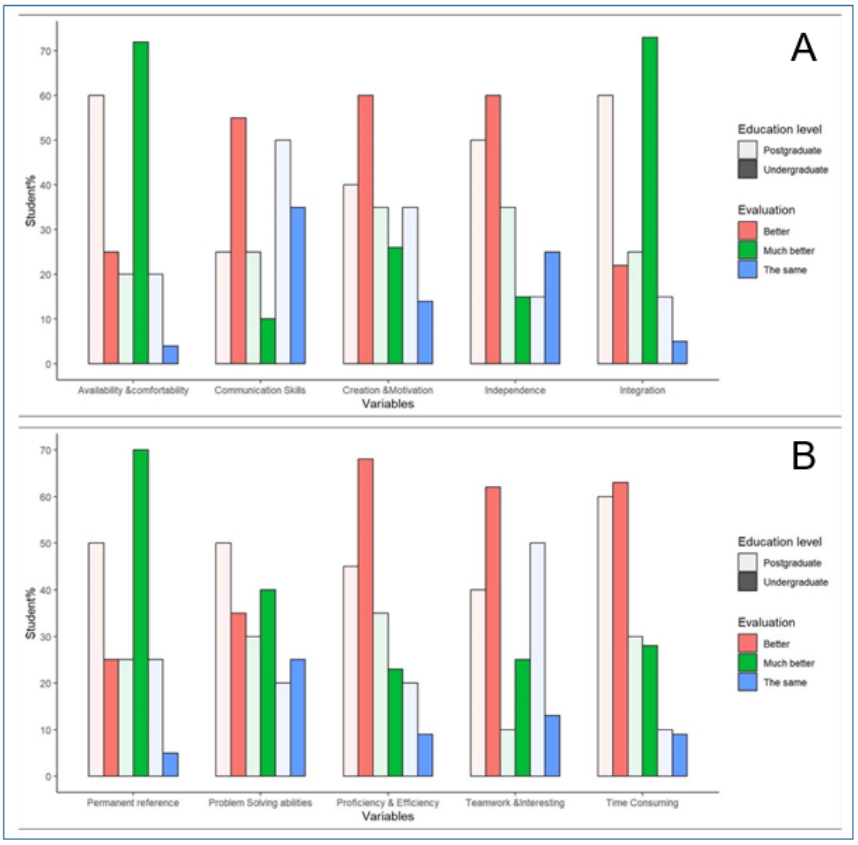


Figure 10: (A) Showing the statistical analysis of research questionnaire carried out on undergraduate students (third year). (B) The statistical analysis of research questionnaire carried out on postgraduates (demonstrators, assistant lecturers, lecturers and assistant professor).

Discussion

Regarding the extraocular muscles, our result came in the same line with those obtained by Getty [12] in small ruminant and Samuelson [16] in domestic animals. However, Liebich and König [11] noticed that the dorsal oblique muscle in domestic animals originated adjacent to the ethmoidal foramen and inserted on the dorsotemporal surface of the eyeball ventral to the insertion of the dorsal rectus muscle. The ventral oblique muscle of the eyeball arose from a tiny depression in the palatine bone and insert on the temporal aspect of the eyeball below the insertion of the lateral rectus muscle. The retractor muscle of the eyeball originated near to the optic foramen and formed as a complete circular cone around the optic nerve. It was inserted posterior to the equator.

The current work of computed tomography proved the same outcomes of Naik *et al.* [10] in humans and Taher *et al*. [19] in dog that only the medial and lateral recti muscles were seen on axial scan, but the superior and inferior recti muscles were incompletely visualized. On

the other hand, the latter muscles were clearly seen on coronal scan. The levator palpebrae superioris and the superior rectus were visualized as a single soft tissue shadow through coronal and high axial views. The inferior oblique was the minor distinct muscle on CT scan, only the insertion was intermittently observable on axial scans. Although Taher et. al and Zwingenberger *et al*. [19,20] noticed that the lacrimal gland situated in dogs dorsolaterally, with its anterior-most extent sited below the supraorbital ligament instead of supraorbital process, goat's head had supraorbital process.

The time taken for making a scan was short considered valuable to avoid motion effects. CT is also considered the most important means for assessment of traumatic injury and for imagining foreign bodies [9].

The current study revealed that the students desired studying using the computer program blended with traditional learning methods. The developed computer program (Adobe flash player program) found on our website and CDs for showing the ocular muscles of goat. Enabling recent university students to utilize computer programs with efficient short and long-term learning strategies enhanced their understanding of anatomy through computer-assisted training. This result was based on our questionnaire which was performed between undergraduate students and postgraduates, this was in harmony with the findings of Shaker [21] in dog, Rezk [22] in some domestic animals, Tolba [23] in equines and Shaker [24] in some types of fish. The use of a multimedia inactive computer program to teach and learn the equine surface anatomy of a thoracic limb enhanced the student's professional skills [23, 25, 26] and in canines [27].

PowerPoint was designated as a projectile containing the basics of the computer program. This has a dual advantage, it simplifies the improvement of the program and subsequently, most students recognized how to use PowerPoint, so it was flexible for them to use the program. The present program had digital images, which raised the attention of students to learn and made anatomy more familiar to them through collaboration. This was in accordance with previous researchers [28-30], who mentioned that computer-based manuscript forms containing pictures and manuscripts with computer graphics or cooperative topography are more appropriate for students recently.

The current study revealed that blended learning, including online learning and traditional methods of teaching, in goat's eye anatomy, was better than online learning alone. This result agrees with Friedl *et al*. and Da Cruz *et al.* [31,32] who revealed that the application of online medical teaching created major barriers. Isolation of students from each other in the educational program, restricted dealing of the educator with students in practical sessions, and unqualified learning of clinical experiences lead to weaknesses of the educational program. Additionally, actual anatomy was a three-dimensional topic that needed understanding of the association between structures and dissection was typical for accomplishing these purposes. So, our study enhanced blended learning to combine the advantages of the two kinds of learning [33].

The present study revealed the advantages of blended learning, which was preferred by most students and postgraduates, but Ostrovsky *et al.* [34] noticed a rise in the number of people utilizing electronics due to technological advancements. Thus, the risk of

asthenopia due to eye fatigue increased, particularly in young people. Complaints of asthenopia included hazy vision, tearing, moisture, a feeling of a foreign body in the eyes, and a decrease in attention. This was a significant state in that it had an impact on focus and academic achievement.

Conclusion

The extraocular muscles fixed the eyeball in the orbital cavity which control movement of the eye. There were four recti muscles; dorsal, ventral, lateral and medial and the two oblique muscles; dorsal and ventral, in addition to the retractor oculi (bulbi) muscle. The four recti muscles controlled the motility of the eyeball according to their position. The dorsal oblique muscle moved the dorsal part of the eyeball ventrally and medially. While the ventral oblique one rotated the eyeball dorsally and medially. Additionally, the retractor oculi muscle acts to withdraw the eyeball. In the end, studying muscular anatomy and movement was considered one of the most important medical scientific studies, which in turn helped surgeons in treating strabismus cases, especially in humans.

Conflict of Interest

The authors have no conflict of interest to declare.

References

[1] Longhurst, G. J.; Stone, D. M.; Dulohery, K.; Scully, D.; Campbell, T. and Smith, C. F. (2020): Strength, Weakness, Opportunity, Threat (SWOT) analysis of the adaptations to anatomical education in the United Kingdom and Republic of Ireland in response to the Covid-19 pandemic. Anat. Sci. Edu. 13: 301–311.

[2] Saverino, D.; Marcenaro, E. and Zarcone, D. (2022): Teaching histology and anatomy online during the COVID-19 pandemic. Clinical. Anat. 35: 129–134.

[3] Sadeghinezhad, J. (2023): Online veterinary anatomy education during Covid-19 pandemic in Iran: Challenges and opportunities. Vet. Med. Sci. 9: 1869-1880.

[4] Succar, T.; Beaver, H. A. and Lee, A. G. (2022): Impact of COVID-19 pandemic on ophthalmology medical student teaching: educational innovations, challenges, and future directions. Survey of ophthalmology, 67: 217-225.

[5] Rinaldi, L.; Veneziano, V. and Cringoli, G. (2007): Dairy goat production and the importance of gastrointestinal strongyle parasitism. Transactions of the Royal Society of Tropical Medicine and Hygiene. 101: 745-756.

[6] Fontanesi, L; Martelli, P. L.; Beretti, F.; Riggio, V.; Dall'Olio, S.; Colombo, M.l Casadio, R.; Russo, V. and Portolano, B. (2010): An initial comparative map of copy number variations in the goat (Capra hircus) genome. BMC Genomics. 17: 639-649.

[7] Escareno, L.; Salinas-Gonzalez, H.; Wurzinger, M.; Iniguez, L.; Solkner, J. and Meza-Herrera, C. (2013): Dairy goat production systems: status quo, perspectives and challenges. Trop Anim. Health Prod. 45: 17-34.

[8] Pujari, A.; Basheer, S.; Rakheja, V.; Gagrani, M.; Saxena, R.; Phuljhele, S.; and Sharma, P. (2019): Extraocular muscle surgery on goats' eye: An inexpensive technique to enhance residents' surgical skills. Ind. J. Oph. 67: 1688.

[9] Malhotra, A.; Minja, F. J.; Crum, A. and Burrowes, D. (2011): Ocular anatomy and cross-sectional imaging of the eye. In Seminars in Ultrasound, CT and MRI. WB Saunders, 32: 2-13.

[10] Naik, M. N.; Tourani, K. L.; Sekhar, G. C. and Honavar, S. G. (2002): Interpretation of computed tomography imaging of the eye and orbit. A

systematic approach. Ind. J. Oph., 50: 339-953.

[11] Liebich, H. G. and König, H. E. (2004): Eye (organum visus), Chapter 16, PP: 547-567. In König, H. E. and Liebich, H.G. (2004): Veterinary Anatomy of domestic animals, textbook, and colour atlas. 1st Edition. Stuttgart, Germany.

[12] Getty, R. (1975): Myology, Chapter 28, PP:791-860. In Getty, R.; Sisson, S. and Grossman, J. D., 1975. The anatomy of domectic animals, 5th Edition, W.B. Saunders, Philadelphia, London, Toronto.

[13] Barnett, K.C. and crispin, S. M. (2002): Feline ophthalmology, an atlas and text. Saunder company, 1th Edition, PP: 255-270.

[14] Barnett, K.C. (2006): Diagnostic atlas of veterinary ophthalmology. Saunder company, 2th Edition, PP: 334-381.

[15] Dyce, K. M.; Sack, W. O. and Wensing, C. J. G., 2010. Textbook of veterinary anatomy, 4th Edition, The sense organs, Chapter 9, PP:332-346. Elsevier Health Sciences.

[16] Samuelson, A. D. (2013): Ophthalmic Anatomy, Section I, Chapter 2, Pp: 39-158. In Gelatt, K. N.; Gilger, B. C. and Kern, T. J. (2013): Veterinary ophthalmology, 5thEdition, Wiley-Blackwell.

[17] Misk, N. (2020): Handout of veterinary ophthalmology, 2th Edition, faculty of veterinary medicine, Assiut university, Assiut, Egypt, PP:155-200.

[18] Lin, H. C. (2015): Comparative Anesthesia and Analgesia of Ruminant and Swine. In: Grimm, K. A., Lamont, L.A., Tranquilli, W. J., Greene, S. A. and Roberson, S. A. (editors). Veterinary anesthesia and analgesia; 5th ed. Wiley Blackwell. Pp, 744-753.

[19] Taher, R.; Abdo, M. and Erasha, A. (2022): Intraocular and Orbital Dimension of the Dog Eye (Canis familiaris). J. Cur. Vet. Res. 4: 197-206.

[20] Zwingenberger, A. L.; Park, S. A. and Murphy, C. J. (2014): Computed tomographic imaging characteristics of the normal canine lacrimal glands. BMC veterinary research, 10: 1-6.

[21] Shaker, N. A. H. (2010): Construction of anatomical learning carrels of the digestive system and osteology of the dog. M. V. Sc. Thesis Cairo University, Egypt, Pp:70-75.

[22] Rezk, H. M. (2010): Some Anatomical Museum Preparations with Special Reference to Respiratory Organs in Some Domestic Animals. Ph. D Thesis, Cairo University. Egypt, Pp:55-57.

[23] Tolba, A. (2010): Reconstituting of the anatomy museum by bringing various teaching materials together to facilitate integrated self- directed learning. Ph. D Thesis. Cairo University, Pp:44-46.

[24] Shaker, N. A. H. (2013): Construction of anatomical modules in some types of fish with special reference to reproductive system. Ph.D Thesis, Cairo University, Egypt, Pp:33-36.

[25] El-Nady, f. (1999): Educational technology in teaching veterinary anatomy with special reference to current techniques in veterinary anatomy and their applications in veterinary practice dealing with some visceral organs. Ph. D Thesis., Cairo University, Pp:45-47.

[26] El-Nady, f. (2002): The electronic atlas of comparative veterinary anatomy, osteology and splanchnology. Vet. Med. J., Giza, 50: 523-531.

[27] Shokery, M.; Elnady, F. and Gadallah, S. (2002): Veterinary orthopedic guidelines on a dog skeletal educational multimedia interactive program. Vet. Med. J., Giza, 50: 501-522.

[28] Boonching, E. (2008): Anatomy lab: a computer graphics program for representing the human anatomy: the 3rd International symposium on biomedical engineering (ISBME 2008), Pp:155-160.

[29] Yeung, J. C.; Fung, K.; and Wilson, T. D. (2011): Development of a computer-assisted cranial nerve

simulation from the visible human dataset. Anat. Sci. edu. 4: 92.
[30] Keedy, A.W.; Durack, J.C.; Sandhu, P.; Chen, E.M.; O'sullivan, P.S. and Breiman, R.S. (2011): Comparison of traditional methods with 3D computer models in the instruction of hepatobiliary anatomy. Anat. Sci. edu. 4: 84-91.
[31] Friedl, R.; Höppler, H.; Ecard, K.; Scholz, W.; Hannekum, A.; Oechsner, W.; and Stracke, S. (2006): Comparative evaluation of multimedia driven, interactive, and case-based teaching in heart surgery. The Ann. thoracic surg. 82: 1790-1795.
[32] Da Cruz, J. A. S.; Sandy, N. S.; Passerotti, C. C.; Nguyen, H.; Antunes, A. A.; Dos Reis, S. T. and Srougi, M. (2010): Does training laparoscopic skills in a virtual reality simulator improve surgical performance? J. endourology, 24:1845-1849.
[33] Thom, M. L.; Kimble, B. A.; Qua, K., and Wish-Baratz, S. (2021): Is remote near peer anatomy teaching an effective teaching strategy? Lessons learned from the transition to online learning during the Covid-19 pandemic. Anat. Sci. Edu. 14: 552–561.
[34] Ostrovsky, A.; Ribak, J.; Pereg, A. and Gaton, D. (2012): Effects of job-related stress and burnout on asthenopia among high-tech workers. Ergonomics, 55: 854-862.

الملخص العربي

التعليم المدمج من خلال برنامج تعليمي عبرالإنترنت أثناء الأزمات يوضح العضلات الخارجية لعين الماعز

ايمان مهدي1 ، علي الدين عبدالباسط 1 ، اسراء بركات1 ، مصطفي عبدالرءوف2 و مرفت قنصوة1
1 قسم التشريح والاجنة كلية طب بيطري جامعة الزقازيق مصر
2قسم الجراحة والتخديروالاشعة كلية طب بيطري جامعة الزقازيق مصر

كانت هناك ست فئات للتعليم الإلكتروني. تشمل التعلم الإلكتروني مع غياب الوجود والتواصل الإلكتروني (التعلم الذاتي) ،التعلم الإلكتروني بالحضور الشخصي ولكن يفتقر إلى التواصل الإلكتروني، التعلم الإلكتروني بدون حضور وبالتواصل الإلكتروني، التعلم الإلكتروني مع التواجد عبر الإنترنت والتواصل الإلكتروني 5- التعلم الإلكتروني مع الحضور المتقطع والتواصل الإلكتروني و التعلم الإلكتروني مع التواجد والتواصل الإلكتروني. لقد أحدثت جائحة كوفيد-19 تغييرًا مفاجئًا في تعليم تشريح العيون، مما أدى إلى إنشاء مناهج مبتكرة عبر الإنترنت. لاظهار وتوضيح عضلات العين لقد اجريت هذه الدراسة علي اثنتين من إناث الماعز لاجراء صور مقطعية علي منطقة الراس خاصة منطقة العين لتوضيح عضلات العين الخارجيه بالاضافة الي تشريح خمس رؤس من الماعز تم الحصول عليها من المجزر الخاص بمدينة الزقازيق – محافظة الشرقيه لتشريح وتوضيح كرة العين وهي متصلة بالمخ عن طريق العصب البصري وكذلك لتوضيح العضلات الخارجيه المسؤله عن حركتها. يعتبر التصوير المقطعي مهَّما لتصوير الاجزاء المختلفة للعين؛ مقلة العين وملحقاتها وخاصة العضلات الخارجية للعين. علاوة على ذلك، من أجل تقييم امتداد المرض خارج مقلة العين نحو تجويف العيني والدماغ. تقوم العضلات الخارجية للعين بتثبيت مقلة العين في حجاج العين والتي بدورها تتحكم في حركة العين. يوجد أربع عضلات مستقيمة؛ العلويه والسفليه والوحشيه والإنسية. وكذلك العضلتان المائلتان هما العلويه والسفليه، بالإضافة إلى العضلة الضامة لمحجر العين والتي توجد حول العصب البصري. يتم التحكم في حركة مقلة العين عن طريق العضلات الأربع المستقيمة وفقًا لموقعها. يوجد عضلتان مائلتان؛ المائلة العلويه التي تحرك الجزء العلوى من مقلة العين سفليا ووسطيًا والمائلة السفليه التي تحرك مقلة العين علويا ووسطيًا. بالإضافة إلى ذلك، تعمل العضلة الضامة العينية على سحب مقلة العين نحو التجويف العيني. واخيرا دراسة تشريح عضلات العين يساعد الجراحين في علاج حالات الحول خاصة في الانسان . اثبتت نتائج الفحص الاحصائي ان الطلبة سواء الخريجيين او في مرحلة الدراسة تفضل التعليم المدمج عن طرق التعلم التقليدية.