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Development of a computer program demonstrating the surface anatomy of the equine' thoracic limb.

Elnady, F. [1], Rezk, H. M. [2] and, Yara S.Abou Elela[3]
1,2,3 Anatomy and Embryology Department at Faculty of Veterinary Medicine, Cairo University, Egypt.
Email: felnady@staff.cu.edu.eg

Abstract

In the present project, we used multimedia technology to develop a computer program demonstrating the surface anatomy of equine' thoracic limb. Microsoft Power Point 2013© was the container for the multimedia assets of the program. It involves explanatory text, images, video clips and audio narrations, in addition to questions and answers for student self-evaluation. The program interface presents a button for each region of the thoracic limb. Prominent and palpable superficial structures within each region were categorized into superficial muscles, veins, arteries, nerves and others. Addressing the clinical relevance to such structures when applicable, made the program more useful to promote knowledge, enhance and facilitate teaching and learning of surface anatomy for both veterinary students, practitioners and horse owners as well.

Keywords: computer program, equine thoracic limb, forelimb, surface anatomy, multimedia

Introduction

Use of cadavers in anatomical studies decreased in the last few years; hence, alternative interactive teaching methods appeared. Use of computer-based programs is one of the successful alternatives. Surface anatomy allows students, surgeons and veterinarians to know the different structures of the body on live animal without dissection. Determining the accurate site for joint injection or nerve block saves time and gives better results. Use of computer programs compared to traditional anatomy teaching methodsis recommended to enhance and facilitate learning (Codd and Choudhury, 2011; Turney, 2007; Galland, Oberst, Lorenz and Mosier, 1995).

Material and Methods

The current project was divided into two different phases. Phase I aimed at surveying and collecting the available data about the surface anatomy of thoracic limbs in equine. Phase II embraced development of a dedicated multimedia computer program addressed to learning surface anatomy of equine thoracic limb.

Production of the multimedia computer program:

Most of the obtained results of our work are encased in the developed computer program. The integrated multimedia assets of the program included images, text, video and audio narration.

The Hardware used for developing the program involved a PC (personal computer) running Windows 8 Pro 2012 Microsoft corporation. Samsung digital camera WB2100, with a resolution of 3072 x 2304 (16 MB) was used to shoot the images and record the video clips. Microphone, Logitech®, was used to record the audio narrations. All the original digital data were collected, sorted in folders and stored on the hard disc and another two backups were kept on My Passport™ WD external hard discs.

The software used comprised Microsoft Windows 8 Professional (operating system), Microsoft office 2013, Adobe Photoshop® Cs6, iMindMap 7.0 and iSpring® Pro 7 which provided tools for manipulating, management and editing images.

Developing the computer program:

All the scientific information incorporated in the developed program were obtained from our results and based on evidence in the review of literature that were collected and refined precisely.

Animal and Image Acquisition: thoracic limbs from horses, donkeys and mules were used in this study.

The original digital images were taken from the prepared specimens in addition to the valuable transparent horse located in the department of anatomy and embryology at faculty of veterinary medicine, Cairo university. The images were saved without any editing into separate folders. Next, the best images were selected to be presented in the computer program. Some of the images were edited using Adobe Photoshop® CS6. The editing process involved removal of the background, adjusting brightness and contrast using various facilities in the Adobe program like levels, brightness and contrast, color balance, and curves. Color cast in some images was removed by going to image, adjustments and variations. The processed images were saved in a PSD format (Photoshop Documents), where all layers are present. Another copy for each image was saved in JPEG format. Labels and legends were added to the JPEG files using Microsoft Word 2013. Arrows and labels were grouped with their respective images to prevent any displacements. The labeled images were finally inserted into Microsoft Power Point® 2013.

Some video clips were recorded on the live animal demonstrating the main prominent and palpable features in the thoracic limbs. Videos were transferred to the computer, saved as Windows Media Video (WMV) files to be embedded into the developed program. Narration of text presented in the program was added, saved as mp3 audio files and inserted into the Power Point program. The developed program using Microsoft Power Point® 2013 was instructionally designed. To facilitate navigation, the main menu of the program was designed using the master slide and action buttons that were built in Power Point; like home, back and next….etc. Other links to various parts of the program were made through inserting hyperlink option within Power Point. Some mindmaps were developed using iMindMap 7.0 to display the organization of each section in the program. iSpring® pro7 was used to convert Power Point program into a flash file.

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Results

User interface. A screenshot of the program interface is shown in **Fig. 1**, displaying the various buttons used for the program navigation. A home button is always available to get back to this main menu at any time.

Clicking the thoracic limb button will display the various regions of the limb. Superficial structures within each region are sectioned into superficial muscles, if any, veins, arteries, nerves, and others like lymph nodes, bursae, ligaments …..etc.

***Mind maps summarized a huge data in one screen for fast and easy reviewing.*Fig. 2** summarizing different structures in carpal region was incorporated into the program for better understanding. Some video clips explaining the surface anatomy on the live horse were inserted into the program.

The program is rich in digital images **Fig. 3**from fresh equine cadavers or fixed specimens and from live animals. Audio narration of some didactic text and comments were added to the program. Drawing of the most prominent and palpable structures was done on the intact limb **Fig. 4** to imagine position of such structures in the live animal. Detailed anatomical structures were presented from dissected fresh cadavers **Fig. 5** and **Fig. 6**. The developed program involved the various approaches used to inject joints and bursae of thoracic limb **Fig.7**. The program also incorporated precise description of sites used for various nerve blocks.

Quizzes were included into the program **Fig. 8**. The quizzes involved multiple choice, matching and true or false question formats. In all instances, each question requires the user to think before he puts his input. In all question formats, feedback is provided immediately after the student response.

Fig. (1). A print screen of the program interface displaying the main menu buttons used in navigation.

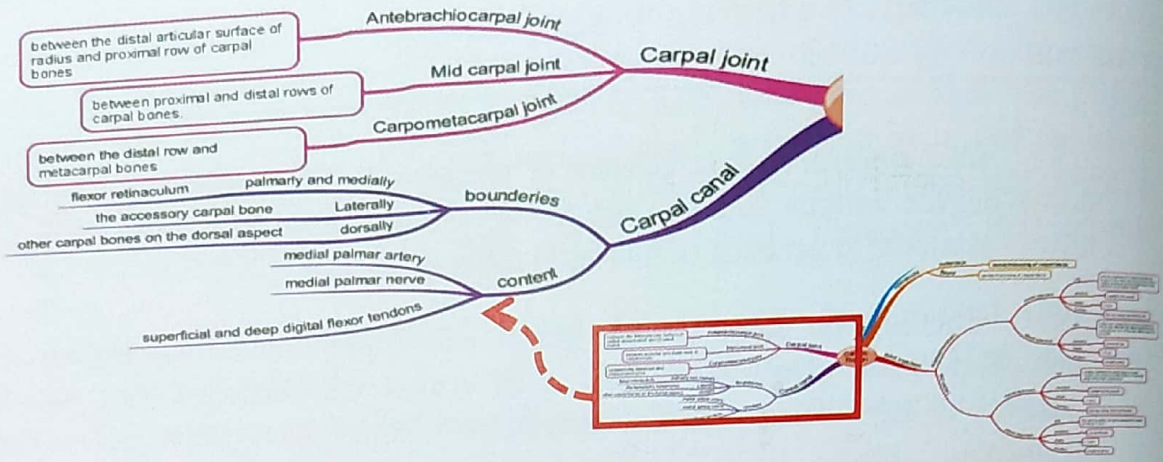

Fig. (2). A print screen from the program displaying a mind map of the carpus.

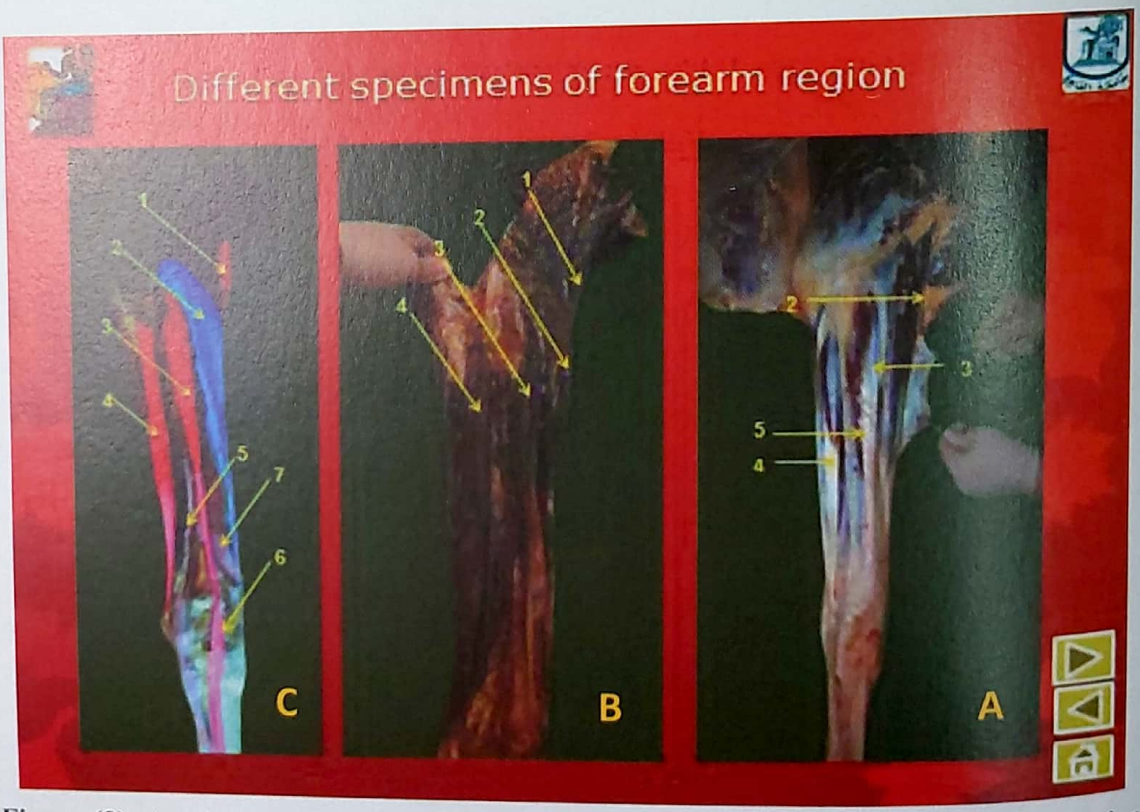

Figure (3). A print screen of the program showing lateral view of right forearm region of a horse (A. fresh B. dry C. colored specimens) showing:

1. Biceps brachii muscle 2. Extensor carpi radialis muscle 3. Common digital extensor muscle 4. Ulnaris lateralis muscle 5. Lateral digital extensor muscle 6. Tendon of common digital extensor muscle 7. Extensor carpi obliquus muscle

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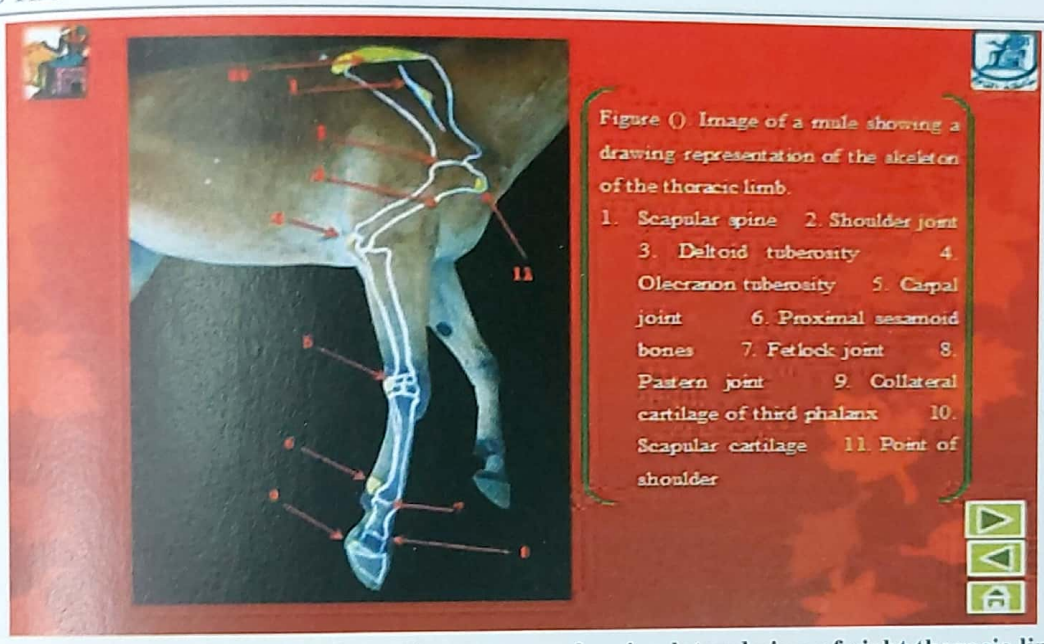

Figure (4). A print screen from the program showing lateral view of right thoracic limb of an embalmed horse. Drawing with acrylic colors to show position of most prominent and palpable features.

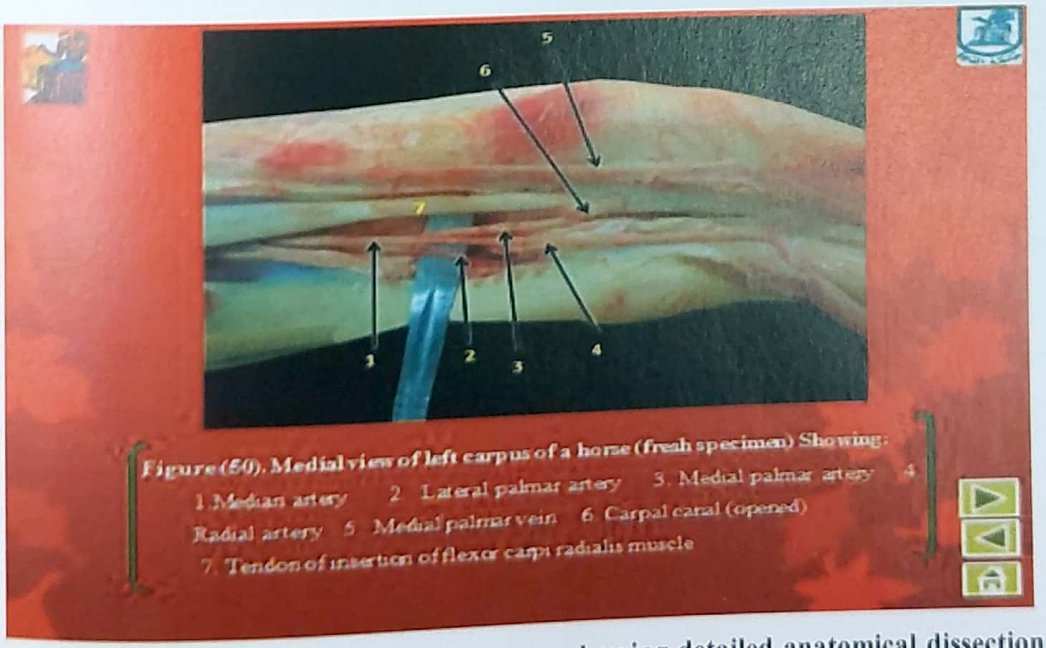

Figure (5).A print screen from the program showing detailed anatomical dissection of fresh cadavers.

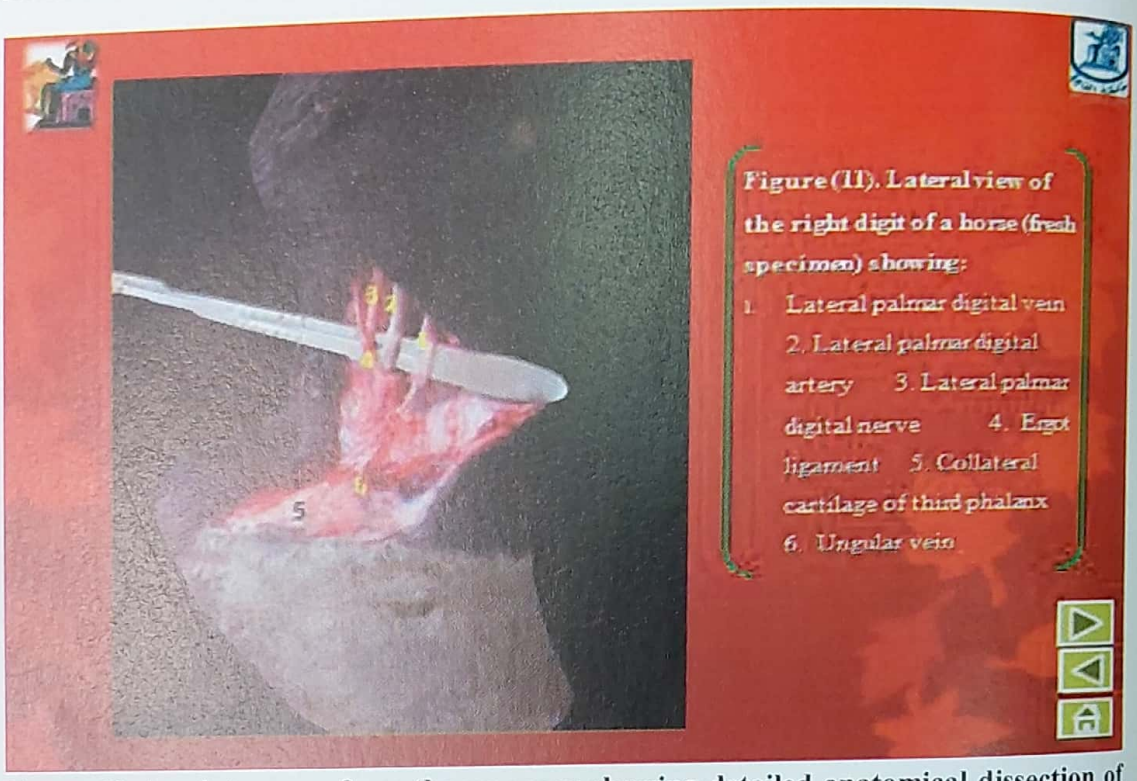

Figure (6).A print screen from the program showing detailed anatomical dissection of fresh cadavers.

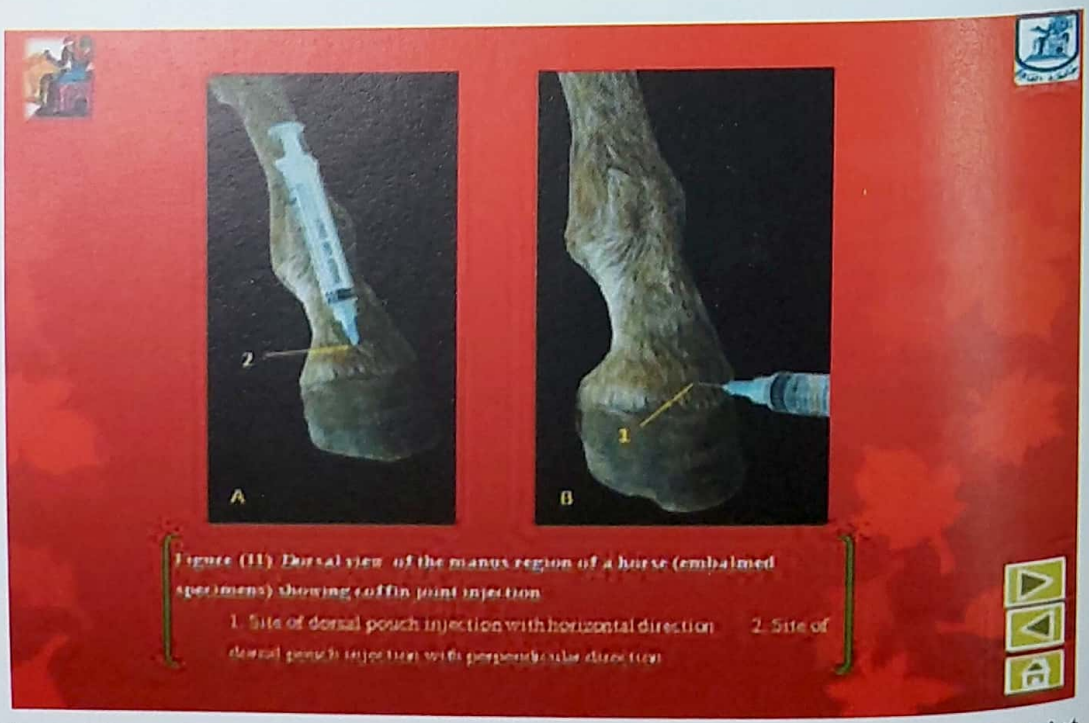

Figure (7).A print screen from the program showing site of injection of the coffin joint.

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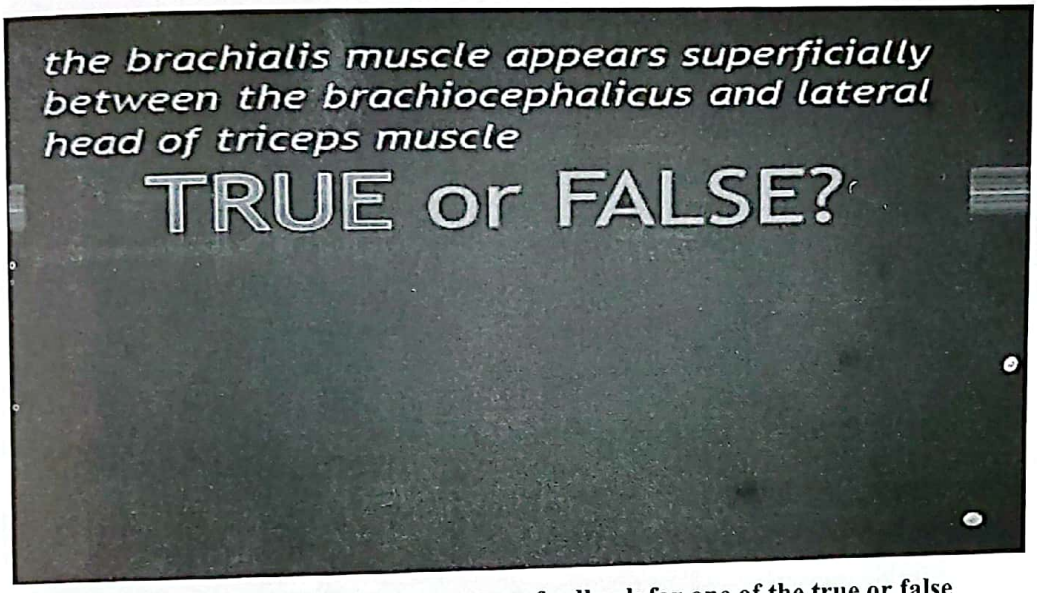

Fig. (8). A print screen showing the program feedback for one of the true or false questions, and the quiz summary showing the score for that particular user.

Discussion

In the last few decades several attempts were made to minimize use of cadavers in teaching veterinary anatomy. This was attributed to the harmful effect of formalin on the health of instructors, students and workers. Moreover, organizations of animal rights and welfare highly restrict the use of animals unless they are obtained from some ethical sources. Also, the risk of transmission of zoonotic diseases from animals to human is another factor in addition to the will to lower the economic cost. Hence, alternative interactive teaching methods such as computer based programs and anatomical modules have been evolved and successfully used. Surface anatomy is defined as part of living anatomy with special reference for its clinical importance (Finn, 2010). Since anatomy to the body is like geography to the world, and dissection of dead animals is made specifically for the sake of live animals, hence the surface anatomy must be in focus for its great clinical importance. Thisis in agreement with Ganguly and Chan(2008) and McLachlan and Patten(2006), who assured that surface andliving anatomy is more effective than cadaveric anatomy in medical education. Moreover, observation revealed that most students were unable to locate or identify the surface anatomical structures on the live animals, despite the fact that many of them have taken the veterinary gross anatomy undergraduate course. In a trial to solve this problem, we developed our program as a forward step in the digital-age learning.

Based on our experience and feedback of previously made questionnaires in the department of anatomy, Faculty of Veterinary Medicine Cairo University, where previously developed computer programs, including CDs for anatomy, surgery and quizzes for self-assessment, were used by veterinary students, the students preferred studying anatomy using the developed software in combination with traditional dissection methods(Rezk, 2010), (Shaker, 2010), (Tolba, 2010) and (Shaker, 2013).

Also the present study revealed that use of multimedia interactive computer program to teach and learn equine surface anatomy of the thoracic limb enhanced the student professional skills by learn the structure of the limb over the skin and detect any site for injection more accurate, this was in harmony with (El-Nady, 1999), (EL-Nady, 2002), (Shokery, Elnady and Gadallah, 2002) and (Tolba, 2010).

PowerPoint was selected as a shell enveloping the elements of the computer program. This has a double benefit; it facilitates the development of the program and since most of students know how to use PowerPoint, it was easy for them to use the program. The presented program, being rich in digital images attracted the visual students to study and become more familiar with anatomy through interaction. This is in agreement with Boonchieng (2008), Yeung, Fung and Wilson (2010)and Keedy, Durack, Sandhu, Chen, O'Sullivan and Breiman(2011)who cited that computer-based text documents containing images and text with animation or interactive features are more applicable for students now. By selection and using PowerPoint there was no need for code typing, or programming of any kind. Use of actions and master slides features within Power Point allowed for ease of navigation and getting back at any time to the main menu.

Pedagogically, there are many learning styles and multiple intelligences, our developed interactive multimedia program tried to cover most of them. For the visual learners we offered high quality digital images, video clips and mind maps. For audio learners, we provided audio narration. For kinesthesia mind maps summarized a huge data in 3 D form. In addition to its different branching colors proved to be attractive and flexible for viewers which are in agreement to what was mentioned by (Buzan, 1986).

Although learning Adobe Photoshop from the beginning was not an easy task, and manipulating images for adjustment and corrections was time consuming, the final, high quality detailed images worth the time and effort. Use of Adobe photoshop facilitates editing of images as removing background and adjusting color tone and other minor corrections. However, labels and arrows on the imageswere added using Microsoft Word 2013© instead of Adobe Photoshop®, because Microsoft word facilitates adding of arrows and transparent text boxes without the hassle of layers in Photoshop. Also, it is much easier to re-edit legends in Microsoft word. The recorded video clips were inserted in WMV format, because it is one of the most suitable formats accepted by Power Point program.

According to our interviews with veterinary surgeons, in our faculty and other veterinary faculties, anatomists and some veterinary students at final years, positive comments were received about the benefits of the program, its user friendly interface, and ease of its use. The aforementioned clients also confirmed the importance of the work for the perfection of their profession.

Future. Users' comments involved also suggestions regarding further development of similar programs to cover other parts of equine body. The program can be utilized all over the world as adjunct tool for learning equine surface anatomy.

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تطوير برنامج كمبيوتر يوضح التشريح السطحي للقائمة الصدرية في الخيل.

Elnady, F.[1], Rezk, H. M.[2] and, Yara S.Abou Elela[3]
[1,2,3] *قسم التشريح و الاجنة كلية الطب البيطري جامعة القاهرة*

في تلك الدراسة قمنا باستخدام تكنولوجيا الوسائط المتعددة لتطوير برنامج كمبيوتر يوضح التشريح السطحي للقائمة الصدرية في الخيل. تم دمج عناصر الوسائط المتعددة داخل برنامج مايكروسوفت باوربوينت© ٢٠١٣. يشتمل البرنامج على نصوص توضيحية، صور، مقاطع فيديو وسرد صوتي للمحتوى. هذا بالإضافة إلى العديد من الأسئلة وإجاباتها وذلك لمساعدة الطالب على التقييم الذاتي. يبرز في واجهة البرنامج زر لكل منطقة من مناطق القائمة الأمامية. تم تقسيم الأماكن البارزة والملموسة داخل كل منطقة إلى عضلات سطحية، أوردة، شرايين، أعصاب، وأخرى. تم تناول الأهمية الإكلينيكية ذات العلاقة بالتراكيب المذكورة كلما أمكن، مما جعل البرنامج أكثر فائدة في تعزيز المعلومات وتسهيل تعلم التشريح السطحي لدى طلاب وممارسي الطب البيطري، ومُرَبي الخيل أيضاً.