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The Teaching of Surface Anatomy by Body Painting

Enseñanza de Anatomía de Superficie Mediante la Pintura Corporal

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SUMMARY: The present project on learning surface anatomy through the body painting method was undertaken because anatomical knowledge supports medical practice. The appropriate anatomical training of the doctor depends on surface anatomy. We considered the renovation of teaching strategies and didactic resources to optimize the overall teaching- learning process. 189 first-year medical students, enrolled in the Trunk and Splanchnology course at the University of Cádiz (Spain) participated in this study. Students were divided into 5 groups each of 38-41 students. The students were asked to complete a satisfaction questionnaire supplied to each participant through an on-line platform. On the basis of the results, we recommend the body painting method as an alternative tool for learning surface and clinical anatomy.

KEY WORDS: Anatomy teaching; Body painting; Learning teaching; Medical education; Surface anatomy.

INTRODUCTION

Anatomy is a living and not an antiquated discipline: this is an argument defended by anatomists in recent years. And this is so because, being an interdisciplinary subject, it is influenced from many medical areas (Turney, 2007). And even from other areas of the sciences. Anatomical knowledge supports medical practice, and despite technological advances in medicine, the physical examination of patients, the interpretation of diagnostic tests, surgical procedures and the formulation of the final diagnosis depend on the appropriate anatomical training of the doctor (Tam *et al*., 2010), particularly on surface anatomy (Regan de Bere & Mattick, 2010).

Currently it is questioned whether the level of knowledge acquired during medical training reaches acceptable levels and whether the traditional methods have become obsolete (Turney; Zurada *et al*., 2011). But it would be more appropriate not to disregard them. Even it was preferred to modify some educational aspects, such as the careful choice of contents or the renovation of teaching strategies and didactic resources, in an attempt to optimize the overall teaching-learning process (Regan de Bere & Mattick).

In Spain, Medical studies last for 6 years, and each University has its own core curriculum. Particularly at the University of Cádiz, Gross Anatomy runs for three semesters. During the first semester of the first year the contents include general morphology, upper and lower limbs. The second semester include trunk, neck and splanchnology. During the third semester, in the second year, we included the head and neuroanatomy. This division into three parts was a recent structure because of new curricula since 2009-2010.

The Anatomy course is structured both in theory lessons and practical sessions. The route of the practical sessions includes prosection, plastinated pieces, practice with plastic and wax models, osteology, radiological anatomy sessions, videos and multimedia sessions, problem-based learning and skills workshops. All these activities used to be carried out in small working groups.

The body painting took place during the last academic year, in the second semester of the first year. It was carried out as part of the course named Trunk and Splanchnology. This course comprises 54 hours of lectures allocated to the whole student group of 189 students. For the practical classes

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students were divided into groups of approximately 20 alumni. These groups were divided into smaller groups for certain activities, such as prosection or workshops. Each student received 28 hours of practical classes.

In this scenario, we set out to design a surface anatomy workshop, with students working in pairs, in which each student could adopt an active role, drawing on each other's bodies. This teaching model, body painting (OpDenAkker *et al*., 2002) is a highly valuable method of helping students improve their three-dimensional view of anatomical structures and it enables students to establish the position of the drawn anatomical projections which have previously been presented during the theoretical and practical courses, as this activity was carried out at the end of the semester. At this point in the course, the students had the possibility of consolidating their acquired knowledge, placing the structures in situ in the living body, these being, the key points of reference for physical examination as well as for surgical procedures and techniques.

Similar experiences have been carried out in recent years (Op Den Akker, 2002; McMenamin, 2008; Fin, 2010; Sugand *et al*., 2010; Nanjundaiah & Chowdapurkar, 2012). This is logical because, in our current educational context, many of those involved in teaching seek to improve and bring their teaching closer to real needs.

If we wish to avoid the distance between anatomy and other clinical disciplines, we will have to build bridges between these two extremes. In an effort to integrate human anatomy, we must strive to provide our students with a better understanding of surface anatomy, which is essential in most branches of medicine. The importance of surface anatomy is so obvious that, as Standring (2012) said "the subject is of more than academic interest". It is an essential part of medical student training enabling them to learn skills that will be carried over into future clinical practice (Boon *et al*., 2002; Hale *et al*., 2010).

MATERIAL AND METHOD

The subjects for this study were 189 first year medical students (60 % females, 40 % males), enrolled in the Trunk and Splanchnology course at the University of Cádiz (Spain) participated in the study. It took place at the end of the second semester of the last academic year, once they had completed their training program. In accordance which the subject organization, students were divided into 5 groups each of 38-41 students, regardless of gender. Sessions took place in the rooms normally used for workshops belonging to the Anatomy Department. Each session lasted two hours and three members of staff who had been involved in the preparation of the general guidelines and protocols were present.

Students were previously informed about this workshop, being instructed to wear comfortable clothing that would allow them to carry out the experiment. Table I showed the list of the structures to be drawn and surface projections of the major organs and structures, which were chosen by the teachers involved. The teachers guided the students, indicating key reference points, in order to reproduce the determined anatomical structures, detecting and correcting mistakes. Within each group of 38-41 students, they worked in pairs and the time allocated to the session -2 hours- allowed them to draw 11 tasks. Every student served both as a painter and as a model, so they adopted both active and passive model roles. Given the peculiar characteristics of this practical lesson, student with objections to nudity were offered the possibility of restricting painting to their backs, necks and abdomen or even of only painting, not serving as models. Female participants could choose to wear two-piece swimming costumes.

Starting from drawings provided by the teachers, students drew the requested structures step by step using cheap and simple materials (non-toxic markers, with washable ink). In general, students were able to draw reference points, selected anatomical structures and organs.

Once this practical session had taken place and to evaluate the course, the students were asked to complete a questionnaire. This was a satisfaction questionnaire supplied to each participant through an on-line platform, Virtual Campus, offered by the University of Cádiz to its students, using free Moodle software. The formal subject Trunk and Splanchnology had virtual support on the internet by means of a course open exclusively to students enrolled in our subject.

The questionnaire developed for this course included 8 items (Table II). Respondents answered questions on a 5-point Likert scale, where 5= strongly agree and 1= strongly disagree which measures the level of importance conceded by each student to each item. The mean, mode, median and standard deviation were calculated by using SPSS v.24.

RESULTS

A surprising outcome was the verification by many of the students that on starting the drawing, they were disconcerted to discover their lack of real knowledge about reference, points and the special orientations of anatomical structures. This fact was very common when students were

Table I. List of the structures to be drawn and surface projections of the major organs and structures.

1.- Triangles of the neck: anterior, posterior and lateral regions and limiting elements
2.- The anterior region of the neck: anterior belly of the digastric muscle, the larynx, trachea, thyroid cartilage, cricoid cartilage, thyroid gland, sternal notch, common carotid artery, internal jugular vein
3.- The lateral region of the neck: sternocleidomastoid muscle, clavicle, trapezius muscle, external jugular vein, subclavian vein artery
4.- The nuchal region: vertebra prominens, nuchal lines
5.- Thorax wall: manubrium, the body, and the xiphoid process, Sternal angle, the second pair of costal cartilages, ribs, the left and right clavicles, pectoralis major muscle, costal margin, costal angle, serratus anterior muscle, main bronchus projections
6.- Thorax projections: heart projection, auscultation points corresponding valves, auscultation areas of heart sounds, lung projections
7.- Abdominal wall: umbilicus, linea alba, rectus abdominis muscles, tendinous intersections, linea semilunaris, arcuate line, external oblique muscle, iliac crest of ilium, the anterior superior iliac spine, the inguinal ligament,
8.- Diaphragm: expiration and inspiration, projections on anterior and posterior trunk
9.- Regions of abdominal wall: quadrants of abdomen (right and left hypochondrium, right and left lumbar, right and left inguinal iliac, epigastric, umbilical and hypogastric)
11.- Abdominal wall projections: liver, spleen, appendix, stomach, duodenum, pancreas
12.- Back: trapezius muscle, medial margin of scapula, vertebral spines, latissimus dorsi muscle, median furrow, erector spinae muscle, iliac crest, L4 spinous process, posterior superior iliac spine, kidney projections.

Table II. Satisfaction questionnaire.

1.- About this surface anatomy session, how do you feel about this experience? Has it been instructive as well as amusing?
2.- I would like to repeat this experience in gross anatomy
3.- I would like to repeat a similar experience in another subject
4.- This activity has allowed me to measure my level of knowledge
5.- This activity has helped me to identify concepts and/or erroneous ideas concerning anatomy
6.-This activity has strengthened my learning about the normal conditions of the human body
7.- I respect my classmates' opinions about this learning
8.- I recommend this activity for classmates in future courses

projecting the diaphragm muscle and the kidneys. The students requested the help of teachers to successfully complete the requested structures and organs. Although we did not forget that this experience could be embarrassing for some of them, few students were reluctant to be painted by a partner, and when this occurred, the embarrassment caused by partially undressing was avoided because they chose to be painted on their backs and/or necks.

Students returned a completed survey, which results showed Table III. It is remarkable that the item most valued by students was the 8th. The participants recommended this activity for classmates in future courses. None of the students selected the minimum value and only four students (4.81 %) chose value 2 on the Likert scale and 45 participants gave the maximum value. Regarding this item both the median and mode were 5.

With regard to whether they would like to repeat the experience, there was a significant difference between carrying it out within the subject of anatomy (mean item 2 = 4.01) or in another subject (mean item 3= 3.91). This result should not surprise us. This type of workshop could be assimilated by other disciplines, such as anesthesia or surgical procedures. We must consider that, as first-year students, they probably did not bear this circumstance in mind. Furthermore, this type of activity could be closely related to the anatomical content.

Table III. Results obtained in satisfaction questionnaire.

Items	Mean (SD)	Median	Mode
1	4.15±0.85	4.00	5.00
2	4.01±0.90	4.00	5.00
3	3.91±1.00	4.00	5.00
4	4.05±0.87	4.00	5.00
5	4.20±0.85	4.00	5.00
6	4.26±0.89	4.00	5.00
7	3.95±1.00	4.00	5.00
8	4.29±0.91	5.00	5.00

Items 4, 5 and 6 measured the value of such a practice for the students' perception of their anatomical knowledge. Students believed this activity helped them to identify erroneous concepts concerning anatomy and measured their level of knowledge.

DISCUSSION

The experience described in this paper is a complementary proposal to other traditional teaching methods, as noted by several authors (Hariri *et al*., 2004; Patel & Moxham, 2006; Tam *et al*.). The use of body painting to assist student learning has proved to be a positive educational experience and its usefulness as an alternative tool has been evaluated (OpDenAkker *et al*., 2002; Aggarwal *et al*., 2006; Finn, 2010). The introduction of body painting in medical teaching is a powerful method to include relevant anatomical concepts, develop spatial orientation skills, visualize the internal landscape of the body from the outside, and train students in undertaking a physical examination. This is possible because they locate structures under the skin by reference to palpable surface features. According to Wilhelmsson *et al*. (2010), students create meaning in anatomy through visualization.

Teaching surface anatomy is both useful and necessary to undertake physical examinations, interventional procedures, and to interpret diagnostic images. Students gain a better perspective on the human body and a more adequate understanding. We have to start from basic knowledge for safe and competent medical practice, and to achieve this, we must ask ourselves if our tasks and teaching methods are the best suited to make this happen. This search for strategies to improve results should be a constant in our educational approaches (Regan de Bere & Mattick).

At the Cádiz Medical School, our anatomy teaching model is mixed: using the traditional manner but also trying to integrate new approaches. In this context we have incorporated the surface anatomy workshops based on body painting. During the sessions we confirmed that a basic knowledge of anatomy is required by students to implement the activity successfully, this was so because the workshops took place at the end of the semester when students had already received all the lectures and had done their practices.

The educational value of the sessions was highlighted by the students, they surprised themselves while they were drawing, noting their lack of knowledge about required structures. In these cases, many students asked the teachers for help to find correct anatomical positions and points of reference. Therefore, the teacher is a facilitator and a resource and the student is responsible for her/his learning, the main principle of student-centered learning (Singha & Kharb, 2013).

Body painting enables medical students to use the information contained in an illustration, going from a two-dimensional representation to a three-dimensional one; in a certain sense it is like a simulation of a real situation between a future doctor and patient. For these body painting sessions, we used volunteers in pairs, live models or simulated patients, but in many of the experiences there was some difficulty both in finding volunteers and in paying the costs in the case of other models (Aggarwal *et al*.; Azer, 2011).

Studies on surface anatomy workshops have been performed (Aggarwal *et al*.; Collett *et al*., 2009; Nanjundaiah & Chowdapurkar), some of them concerning the attitude of the student towards participating in them, because they found it embarrassing. In our case, without forgetting that the practice could have been embarrassing for some of them, the result was surprising. Very few students expressed reluctance about being painted by a partner, and in this case, the embarrassment caused by partially undressing was avoided because they selected to be painted on their backs and/or necks. The level of undressing is obviously dependent upon the part of the body being painted.

Furthermore, as in the experience reported by Finn, we appreciated that students themselves enjoy and relax which promoted a positive learning environment. They also defined it as an amusing experience. Despite the fact that it took place in a relaxed atmosphere, we did not lose the formal academic context, and we believed that it was precisely this professional approach that helped the students in pairs. Even, observing both passive and active roles, they saw themselves as patients and doctors respectively, forgetting the embarrassing aspect of the sessions.

Furthermore, Bolander Laksov *et al*. (2008) referred to "the transfer problem", a problem of recalling information from memory. We propose body painting as a tool to overcome this situation, so that previously learned knowledge about normal body structures can be used properly in later real-life situations in the medical career. With the implementation of this methodology, we believe they are addressing several deficiencies, in particular about learning surface anatomy.

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RESUMEN: El presente proyecto sobre el aprendizaje de la anatomía de superficie a través del método de pintura corporal se realizó debido a que el conocimiento anatómico apoya la práctica médica. El entrenamiento anatómico apropiado del médico depende de la anatomía de superficie. Consideramos la renovación de las estrategias de enseñanza y los recursos didácticos para optimizar el proceso general de enseñanza-aprendizaje. De este estudio participaron 189 estudiantes de primer año de medicina, matriculados en el curso de Troncal y Splanchnology en la Universidad de Cádiz (España). Los estudiantes fueron divididos en 5 grupos, cada uno de 38-41 estudiantes. Se les pidió a los estudiantes que completaran un cuestionario de satisfacción proporcionado a cada participante a través de una plataforma en línea. Sobre la base de los resultados, recomendamos el método de pintura corporal como una herramienta alternativa para el aprendizaje de la anatomía de superficie y clínica.

PALABRAS CLAVE: Enseñanza de la anatomía; Pintura corporal; Aprendiendo la enseñanza; Educación médica; Anatomía de superficie.

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