Dynamic Model of Applied Facial Anatomy with Emphasis on Teaching of Botulinum Toxin A

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Background: The use of botulinum toxin type A is considered one of the most revolutionary and promising face rejuvenation methods. Although rare, most of the complications secondary to the use of botulinum toxin A are technician dependent. Among the major shortcomings identified in the toxin administration education is unfamiliarity with applied anatomy. This article proposes the use of body painting as an innovative method of teaching the application of botulinum toxin A.

Methods: Using the body painting technique, facial anatomy was represented on the face of a model showing the major muscle groups of botulinum toxin A targets. Photographic records and films were made for documentation of represented muscles at rest and contraction.

Results: Using the body painting technique, each of the muscles involved in facial expression and generation of hyperkinetic wrinkles can be faithfully reproduced on the model’s face. The documentation of the exact position of the points of application, the distribution of the feature points in the muscular area, the proper angulation and syringe grip, as well as the correlation of the points of application with the presence of hyperkinetic wrinkles, could be properly registered, providing professional training with information of great practical importance, development of highly effective treatments, and low complication rates.

Conclusion: By making it possible to interrelate anatomy of a function, body painting is proposed in the present study as an innovative method, which in a demonstrative and highly didactic manner presents great potential as a teaching tool in the application of botulinum toxin A. (Plast Reconstr Surg Glob Open 2017;5:e1525; doi: 10.1097/GOX.0000000000001525; Published online 28 November 2017.)

INTRODUCTION

The use of botulinum toxin A is considered one of the most revolutionary face rejuvenation methods, and is the nonsurgical cosmetic procedure most performed in the world.1

Furthermore, Carruthers et al.2 suggest that botulinum toxin A is remarkably safe and effective in reducing dynamic wrinkles.

The planning that precedes the application is critical to the construction of satisfactory results.3 A thorough clinical assessment, considering the type of skin, the distribution of expression lines and mass, contractile force, and anatomical distribution of facial muscles, allows for a greater understanding of the needs of each individual.4 The best results occur from the determination of the application points according to the needs of each patient.1–5

Although rare, most of the complications secondary to the use of botulinum toxin A are technician dependent; therefore, a great effort from who minister on the subject, to properly prepare new injectors and provide for those who are already applying botulinum toxin A a chance to relearn and refine their techniques.10–12

Among the major shortcomings identified in the teaching of botulinum toxin A administration is the applied anatomical ignorance and lack of ability to interrelate muscle contraction to hyperkinetic wrinkles selectively.

The atlas of anatomy, anatomical resin parts, and cadaver dissections are excellent choices for the study of anatomy but do not allow the interrelation of muscles with dynamic
wrinkles, because the models are inanimate. The clinical examination of the patient, botulinum toxin A candidate, is mandatory and essential in developing the best application technique; however, as a sole teaching method, it does not allow the direct visualization and selection of the muscles responsible for facial hyperkinesia.13

Body painting is an art form that began in prehistory and that persists to the present time. In this type of art, the artist uses the human body as a true screen for expression of beauty and creativity in a unique way. Records of various tribes of Africa, Europe, Asia, and Australia reported the importance of body painting in the social and religious organization of these people.14

In modern times, the first record of the use of body painting as art dates back in the year 1933, when the famous inventor of cosmetics, Max Factor, caused a lot of confusion with the exhibition of a nude model at the Chicago World’s Fair.15 Body painting spread intensively in the 60’s, when Western artists who were influenced by the hippie movement began using this type of art to explore sexuality and psychedelic experiences. With its popularization, body painting has not been applied only to fully naked female body, but also to other parts of the body like the back, hands, legs, and face.16

Today, many medical schools have replaced traditional methods of anatomy study by living anatomy, with the use of realistic models and body painting.17–23

To contribute to the enrichment of teaching techniques in botulinum toxin A, we propose the use of body painting as an innovative method, in a demonstrative and efficient manner providing the incredible opportunity to interrelate anatomy and function.

**MATERIALS AND METHODS**

To carry out this study, a 37-year-old model was selected, phototype II, Mark Rubin II, and Glogau II, with the presence of hyperkinetic wrinkles in the forehead, glabellar, side perialpebral, nasal dorsum, and perioral region, in addition to the presence of platysmal bands. The model took part in the study voluntarily and signed terms of consent and authorization of the use of her image.

After a thorough cleaning of the face using soap and makeup remover, the model was positioned 70 cm in front of a black lycra background, sitting on a revolving bench. The distance between the face of the model and the photo/video camera was kept constant (1.5 m). The height of the camera was also kept constant by a rigid rod and a universal support, and it was horizontally directed to look at the model. The camera used for the records was a Canon 5D Mark III, Canon 24–70 mm lens, and an HDTV Sony camera with 1440 × 1080 resolution. In a bright room by 2 points of light of 600, E-4200 Image lumens LED, the model was photographed with her resting face in the following positions: front, anterior oblique right and left (45°), and bilateral complete profile. The photographic records and filming were performed including the entire circumference of the head, extending
from the skull vertex to the sternoclavicular joint (sternal notch), with the major axis of the camera’s frame upright. Later, pictures were taken in detail plan, registering a way to segment and in maximum muscle contraction, the hyperkinetic wrinkles located in various areas of interest

With the collaboration of an artist who used watercolors, appropriate for use on skin, as well as lipstick and eyeliner, the frontal muscles, corrugator, orbicularis oculi, procerus, transverse nose, orbicularis oris, and platysma were designed on the model’s face using the body painting technique. The muscles were plotted with respect to origin and insertion, as well as the dimensions and direction of fibers (Fig. 3). New photographic records and footage were then performed to document selectively anatomical details and contraction capacity of each of the muscles studied, as well as the presence of hyperkinetic wrinkles generated by these muscles.

RESULTS

Using the body painting technique, each of the muscles involved in facial expression and generation of hyperkinetic wrinkles could be faithfully reproduced on the model’s face. Muscles such as the front, the corrugator, and procerus, among others, had their origins and insertions represented. The arrangement of muscle fibers, possible anatomical variations, and interrelation with surrounding muscles could be clearly recorded on the skin’s surface. However, the major technical contribution was to permit detailed study of the facial anatomy associated with dynamic muscle, the contraction of each of the muscles involved, and detailed analysis of wrinkles produced by them. Respecting the technical conditions laid down for the proper photographic documentation and recording, selective recording of each of the facial muscles provided the imaging with anatomical detail and highly realistic function (Fig. 4).

The reproduction of the facial muscles in all the model’s right hemiface provided, in great detail, the opportunity to document the intrinsic relationship between them, which with synergistic or antagonistic movements, defines the facial mime.

To the observer, the body painting provided the chance of viewing all facial muscles involved in mimicry working jointly and dynamically, as well as their influence on the generation of hyperkinetic wrinkles (Fig. 5; see video, Supplemental Digital Content 1, which demonstrates facial muscles involved in mimicry working jointly and dynamically, as well as their influence
on the generation of dynamic wrinkles, http://links.lww.com/PRSGO/A616).

The option to reproduce the facial muscles in just one hemiface gave the viewer the possibility of carrying out a comparative analysis with the other hemiface, which, without the application of body painting, was subjected exclusively to clinical examination.

As a teaching method applied to learning the administration of botulinum toxin A, body painting provided an effective didactic experiment with the registration of all technical detail of the drug application. With the positioning of syringe and needle for each target muscles of the treatment, it was possible to document the exact position of the application points, distribution of the points on the muscular area, and action of the drug from halo, aside from the proper angle and grip the syringe should have, facing the anatomical requirements of each muscle (Fig. 6). The high technical point was to allow the correlation of each of the points, with muscle function and the presence of hyperkinetic wrinkles, providing professional training information of great practical importance for the preparation of highly effective treatments and low complication rates (see video, Supplemental Digital Content 2, which demonstrates the botulinum toxin A administration technique correlating the application points with the anatomy, http://links.lww.com/PRSGO/A617).

DISCUSSION

Facial dynamic wrinkles are secondary aesthetic alterations to muscle contraction and skin quality impairment, which gradually settle along the natural aging process.

Botulinum toxin A is an important tool used in facial rejuvenation that has the main function of promoting muscle relaxation and hence the attenuation of the dynamic wrinkles.

Among the many fundamental conditions for being able to use botulinum toxin A to promote facial rejuvenation is applied anatomical knowledge. Knowing the various facial muscles involved in mimicry, their origins, insertions, and functions is thus mandatory.

For professionals who teach the subject, having a good educational model is fundamental in the transmission of knowledge. The models conventionally used do not allow the dynamic evaluation of facial muscles, while the evaluation of muscle contraction in an alive patient does not allow clear viewing of facial anatomy. In our opinion, the body painting is a highly didactic and easily reproducible tool, which provides the pleasant integration between anatomy and function. The body painting is a new educational trend that is able to provide the trainees the opportunity to connect with the living and realistic anatomy.

Fig. 6. A practical demonstration of the botulinum toxin A administration technique correlating the application points with the anatomy, muscle function, and presence of hyperkinetic wrinkles.
CONCLUSIONS

In the application of botulinum toxin A, comprehensive understanding of functional anatomy is crucial for maximizing outcomes. By providing a representation of the entire facial musculature on the cutaneous surface, interrelating anatomy and function, body painting is proposed in this study as an innovative method, which in a demonstrative and highly didactic manner presents great potential as a teaching tool in the application of botulinum toxin A.

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