

Classification of periorbital wrinkles and treatment with Botulinum Toxin Type A

Classificação das rugas periorbitárias e tratamento com a toxina botulínica tipo A

Original Article

ABSTRACT

Introduction: Periorbital wrinkles are an important component of facial aging that can be minimized with botulinum toxin treatment.

Objective: To treat periorbital wrinkles through botulinum toxin injections in the orbicularis muscle, using classic lateral points and additional points in the lower eyelid, which were developed based on the classification of these wrinkles.

Methods: Clinical and photographic data from 530 patients who had periorbital wrinkles classified and treated between 2002 and 2007 were analyzed.

Results: Thirty percent of patients over 45, and 80% of those under 45, demonstrated complete improvement of the wrinkles after treatment in the classic points. The remaining patients needed treatment in the additional points in the lower eyelids.

Conclusion: The classification of wrinkles helped improve treatment. Despite the considerable benefit offered by injecting in the classic points, the necessity of treating additional points in the lower eyelids with botulinum toxin was verified. The presence of subcutaneous cellular tissue and the patient's age should also be taken into consideration.

Keywords: aging; eyelids; classification.

RESUMO

Introdução: As rugas peri orbitárias constituem importante componente do envelhecimento facial e podem ser minimizadas através do tratamento com toxina botulínica.

Objetivo: Tratamento de rugas periorbitárias através de injeções de toxina botulínica do músculo periorbicular, abrangendo os pontos laterais clássicos e outros adicionais na pálpebra inferior, desenvolvidos a partir da classificação destas rugas.

Métodos: Foram revisados dados clínicos e fotográficos de 530 pacientes, no período de 2001 a 2007, que tiveram suas rugas periorbitárias classificadas e tratadas com toxina botulínica.

Resultados: 30% dos pacientes com idade superior a 45 anos e 80% daqueles com idade inferior a 45 anos apresentaram melhora total das rugas após tratamento nos pontos clássicos. Os demais necessitaram tratamento nos pontos adicionais da pálpebra inferior.

Conclusão: A classificação das rugas facilitou o encaminhamento ao melhor tratamento. Apesar do grande benefício trazido pelos pontos clássicos, verificamos a necessidade do tratamento com toxina botulínica nos pontos adicionais. Devem ser também levadas em consideração a presença de tecido celular subcutâneo e a idade do paciente.

Palavras-chaves: envelhecimento; pálpebras; classificação.

Authors:

Bhertha M. Tamura¹
Marina Y. Odo²

¹ Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

² Dermatology Department, Universidade de Santo Amaro, São Paulo, Brazil

Correspondence:

Dr Bhertha Miyuki Tamura
Rua Ituxi, 58/603 - Saúde
04055-020 - São Paulo - Brazil
Email: bhertha.tamura@uol.com

Received on: 03/01/2011

Approved on: 10 / 05/2011

This study was carried out at the authors' private practices in São Paulo, Brazil.

Conflict of interests: none
Financial support: none

INTRODUCTION

Dynamic wrinkles, which result from the muscular activity linked to facial mimicry, are an important component of facial aging, along with photoaging, cutaneous sagging and volume alterations caused by osseous and subcutaneous tissue reabsorption.^{1,2}

The systems and scales classifying and standardizing facial wrinkles have been useful not only in assisting in the choice for the best individualized treatment, but also in comparing results among different treatments that are also used in the preparation of scientific investigation protocols.³

With regard to dynamic wrinkles, several studies have been published suggesting classification systems for the glabellar,⁴ nasal,⁵ and frontal⁶ regions.

Dynamic palpebral wrinkles are a frequent complaint from patients. They are mainly caused by the hyperactivity of the orbicularis oculi muscle of the eyelid, whose contraction can be effectively prevented by using botulinum toxin type A (BoNTA), a neurotoxin produced by the *Clostridium botulinum* bacterium which blocks the release of acetylcholine in the neuro-muscular junction.⁷

The classic application points for treating periorbital wrinkles using (BoNTA) are well known. (BoNTA) administration using the classic application points mainly acts on the orbicularis oculi muscle, lateral to the external canthus. According to Carruthers and other authors,^{8,9} three classic points are utilised for the application of BT in this region. Such points are distributed between the brow and the zygomatic arch, the distance between each being 0.5–1 cm. They are located between 1 and 2 cm from the bone border, forming a semi-circle.

Notwithstanding, the orbicularis oculi eye muscle is circular and the majority of its insertion points are located in the soft tissues, which allow it to work as the sphincter muscle of the eyelids. Therefore, unlike other muscles which have osseous insertion points that can be fully relaxed with only one application point, the orbicularis oculi muscle will not be fully relaxed if only one of its insertion points is blocked. As a result, additional application points of BT into this muscle – in addition to those in the lateral region – have been developed over the last few years.

Based on some of the common features of palpebral wrinkles and with the objective of obtaining better aesthetic results from the application of BT, the authors devised a treatment for the orbicularis oculi muscle, based on a classification system for periorbital wrinkles, which includes the classic lateral points together with additional ones located in the lower eyelid.

METHODS

A prospective, longitudinal, analytical study was carried out. The effects of BoNTA on the wrinkles of the periorbital region were assessed by means of clinical examination and photographic documentation in 530 patients treated at the authors' private practices from 2001 to 2007. The study was carried out in accordance with the ethical principles set out in the Declaration of Helsinki 2000.

A detailed understanding of the regional anatomy, particularly of the orbicularis oculi muscle, was instrumental for the study's objective. This anatomical structure is located immediately below the epidermis, in an area where subcutaneous tissue is either scarce or absent. It has the shape of an elliptical muscular sheet subdivided into three parts: (a) the pars orbitalis arises in the frontal process of the maxilla and in the nasal process of the frontal bone, and surrounds the opening of the orbit and inserts close to the origin. It covers the orbital margin and connects to several fibers of the frontalis muscle; (b) the pars palpebralis begins in the medial palpebral ligament, passes through each eyelid and inserts into the lateral palpebral raphé; (c) the pars lacrimalis (or Horner's muscle) arises in the posterior lachrymal crest, in the pre-septal medial portion, passing behind the medial palpebral ligament and crossing the lachrymal sac to join the palpebral portions (Figure 1). Other authors subdivide this muscle into two parts: palpebral and orbital.¹⁰

The zygomaticus major and minor muscles are also important since they can be involved in the interesting muscular complex of the periocular region. They arise in the malar bone (the zygomaticus major laterally and the zygomaticus minor medially,) and insert into the orbicular muscle of the mouth (the orbicularis oris muscle).¹¹ If incorrectly relaxed by an injection of BT in the palpebral region, these muscles can cause undesirable asymmetries in the perioral region. Therefore, both muscles must be identified correctly.

Based on observations of the anatomical details and muscle dynamics in these patients, and considering the specific characteristics of individual patients, the authors developed the following classification system for the wrinkles of the periorbital region (Figure 2):

- Type I – Wrinkles lateral to the external canthus of the eye, extending from the brow to the zygomatic arch
- Type II – Wrinkles lateral to the external canthus of the eye, extending from the line of the external canthus of the eye to the zygomatic arch (absence of wrinkles in the superior lateral region)
- Type III – Presence of wrinkles in the line of the external canthus only

These three types of wrinkle can occur together with:

- A – Absence of lower eyelid wrinkles
- B – Presence of lower eyelid wrinkles, according to the following sub-classification:
 - B1 – Lateral wrinkles
 - B2 – Medial wrinkles
 - B3 – Wrinkles in the internal canthus

Patients included in the study were observed and classified according to this system and possible combinations thereof. Patients were asked to move their facial mimicry by forcing a smile, to allow the identification of the exact position of the orbicularis oculi muscle. Additionally, the lateral border of the orbicular bone was palpated. After classification of the wrinkles

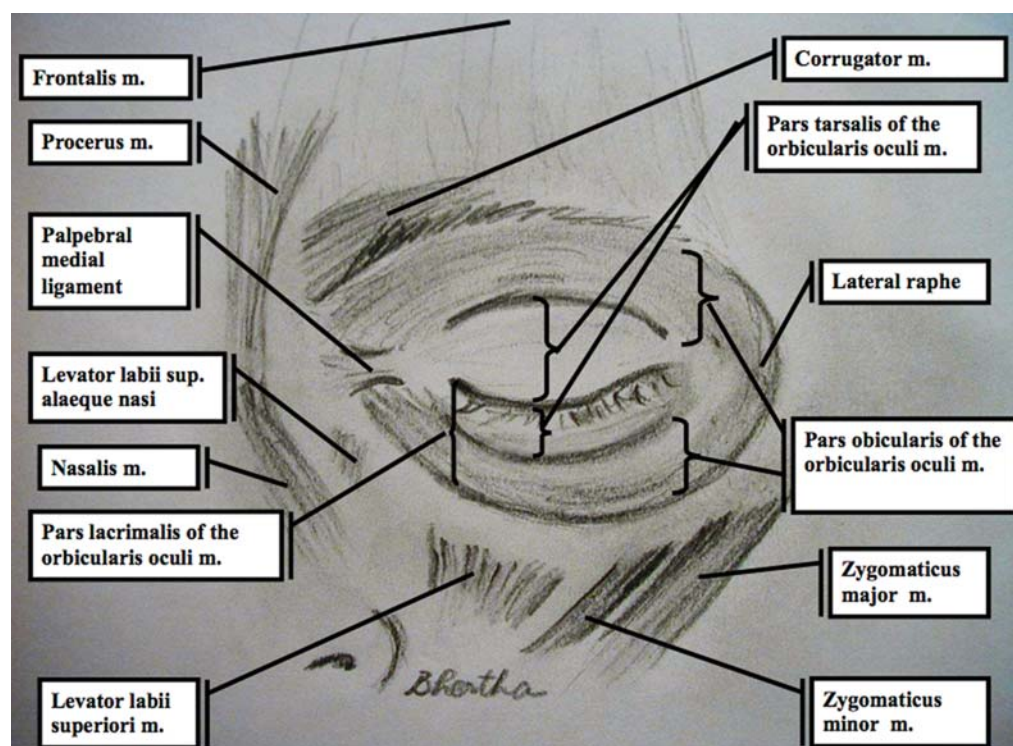


Figure 1: Superficial anatomy of the periorbital region.

was carried out, standardized photographs were taken of all patients, both when the orbicularis oculi muscle was at rest and when it was contracting. One hundred units of BoNTA (Botox®; Allergan, Inc., Irvine, CA, USA) were diluted in 2 ml of saline solution and 30G × 1/2" needles were used to inject the toxin.

The initial application was made in three points for Type I patients, in two points for Type II patients and in a single point for Type III patients, with 2–3 units of BoNTA being injected into each point.

When a fourth point, below the three classic points, was needed to achieve the desired effect, the exact insertion point of the zygomatic muscles was measured and BoNTA was applied superficially (2 mm deep) to avoid asymmetries in the periorbital region.

At the second follow-up visit, 1 month after initial application, when wrinkles in the lower eyelid were identified, doses of 0.5–1.0 unit of BT were applied in additional points, according to the location of the wrinkles (Figure 3):

- Type B1: This was observed in the lateral region of the lower eyelid and, after palpation of the orbicularis oculi muscle on the zygomatic arch, was treated with an intradermal injection of BoNTA into the point located 1 cm medially and inferiorly in relation to the most caudal point of Types I or II.
- Type B2: This was observed in the medial region of the lower eyelid and treated with an intradermal injection into the point located between the ciliary border and the orbital border, in the mid-pupillary line.
- Type B3: This was observed in the medial and inferior region in relation to the internal canthus of the eye, becoming

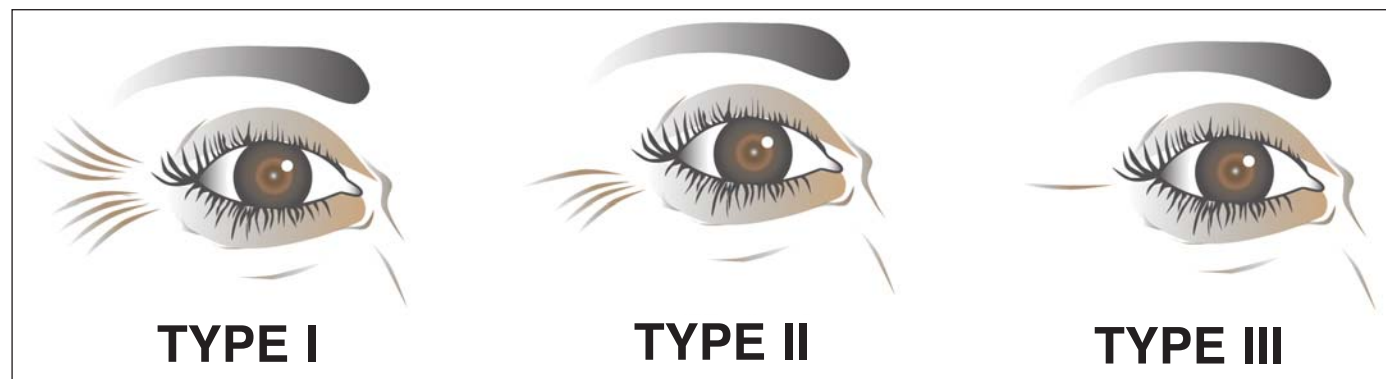


Figure 2: Primary classification of the wrinkles located in the periorbital area.

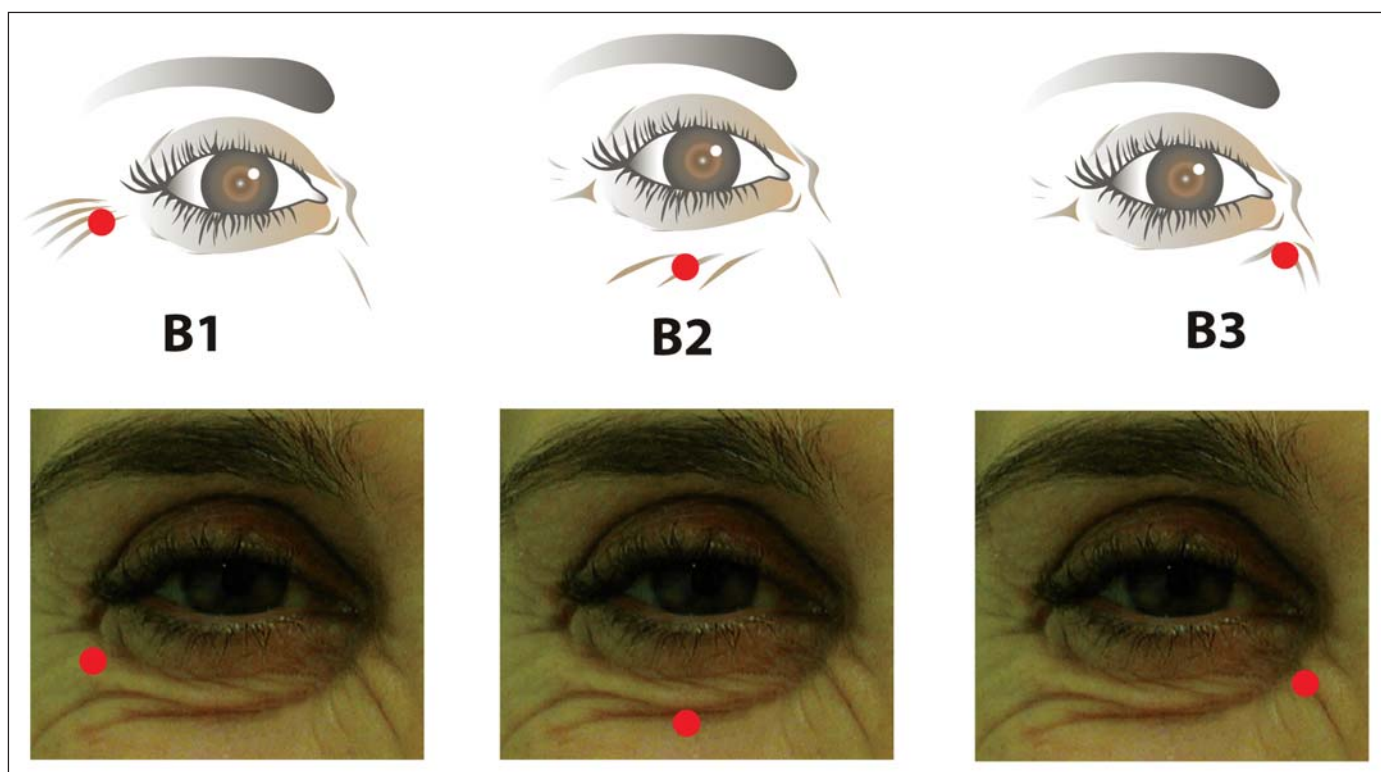


Figure 3: Classification of the wrinkles of the lower eyelid, with their respective application points

noticeable when the pars palpebralis of the orbicularis oculi muscle exerts a more evident contraction than that of the pars orbitalis; it was treated with intradermal injection into a point located 5 mm below the internal canthus of the eye, in the center of the contraction area.

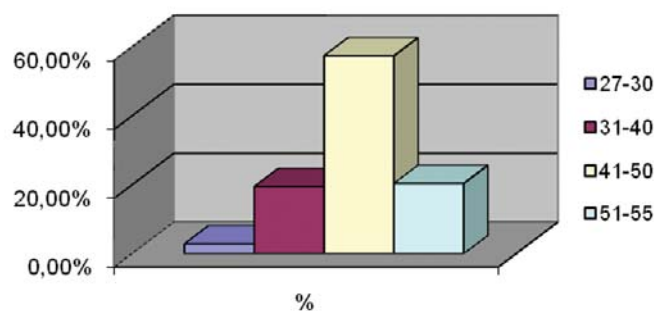
In some cases, a few wrinkles persisted in the external canthus of the eye, within the orbital border. In those cases, 0.5 unit of BoNTA was injected into the dermis, between the external angle of the eye and the external margin of the orbital border.

All patients were clinically assessed and analyzed using standardized photographs taken before treatment and 30 days after each treatment session.

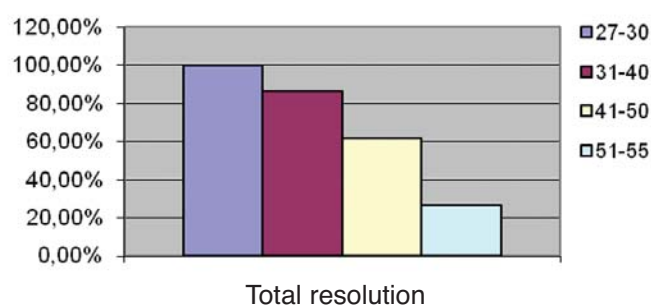
RESULTS

The ages of the 530 patients ranged from 27 to 55 years (average: 49 years), with 280 patients older than 45 and 250 younger than 45 (Figure 4). Ten percent were of Asian origin, 0.1% were of Afro-Brazilian origin, 89% were white, and 90% were women.

Eighty percent of patients younger than 45 (200) and 30% of patients over the age of 45 (84) presented total improvement of the wrinkles after the first session (Figure 5). The remaining patients needed treatment in the additional points of the lower eyelid, with the number of units and points varying according to the individual patient (Figure 6).



Graph 1: Patients distribution by age group



Graph 2: Percentage of resolution with classic points



Figure 4: Patient with Type I-B2/B3 wrinkles, pre- and post-treatment

Patients with no palpable subcutaneous tissue mainly presented Type I-B1, Type I-B2 or Type I-B3 wrinkles. Individuals with palpable subcutaneous tissue mainly presented Type II, infrequently combined with B1 or B2. The anatomical difference between the presence and absence of palpable subcutaneous tissue was more important than age. The most frequent complications were local pain (5%), edema (4%), ecchymosis (1%), and pseudo-herniation of fat (0.1%).

DISCUSSION

The classic points of BoNTA injection, as described by Carruthers in 1998, are located in the lateral portion of the orbicularis oculi muscle.⁸ Despite being very useful in the treatment of wrinkles, they occasionally are not enough to achieve a successful outcome, therefore leading to the search for improved results.

In 2000, Talarico described cases of patients in which the external canthus of the eye and the superior line of implantation of the ear were unusually distant from each other and required a second line of points intercalated with the three classic points.¹²

Different classification systems for dynamic wrinkles in different facial regions have been published, leading to an important advance in obtaining better results with BoNTA application.⁴⁻⁶

Additionally, in-depth study of facial anatomy ensures that safety is maintained when injecting BoNTA, which causes temporary chemical denervation of the neuromuscular junction fibers.

In addition to a detailed understanding of the different parts of the orbicularis oculi muscle, further important anatomical regions must also be detected and considered when treating this region, namely the orbital rim (which must always be located by means of palpation), the infrapalpebral skin, and the insertion points of the zygomaticus major and minor muscles.

Based on anatomical studies of the palpebral region, on the perception of how the muscular system of each individual patient is structured and works, and on the data from patients who needed additional injection points (in addition to the classic points), the authors developed a classification system mainly aimed at the treatment of the wrinkles in the lower eyelid.

In 2003, Kane published a classification of periorbital wrinkles, which, however, did not comprise the lower eyelid.¹³ Flynn described a point located 3 mm below the cilia of the lower eyelid, in the medial region of the lower eyelid, in the region of the pre-septal orbicularis oculi muscle, taking the midpupillary line as reference, with a view to increasing the ocular opening. The result of the BoNTA injection into this point is very good. However, if the patient presents a flaccid periocular musculature and excess or ptosis of the inferior peri-orbicular fat tissue, those features can become even more evident.¹⁴ The point developed to treat B2 wrinkles is also located in the midpupillary line, but in a more inferior location.

In order to avoid the undesirable effects of BoNTA application in the palpebral region, careful clinical examination and critical analysis of the medical history of the patient, which focuses on several important features – such as the existence of

visible adipose tissue in the infraorbital region, the presence of sagging in the muscle or at the edge of the eyelid, the patient complaining about ocular edemas – are fundamental.

If any of these important features apply, the authors do not recommended that BoNTA is applied to the lower eyelids, since this could lead to a worsening of the condition.

Additionally, the precautions that must be taken when treating the palpebral region by injecting BoNTA are very important. With regard to the classic points, the substance should be applied laterally to the orbital rim; in the infrapalpebral points the injection must be made into the superficial dermis to avoid paralysis of the oculomotor muscle and, in turn, the needle must always be directed against the ocular conjunctiva, to avoid undesired traumas.

Other observations that ensure the safety of this procedure are: the number of points and units, according to individual variations, and small doses and volumes.

In the present study, we demonstrated that the classification of wrinkles and the use of the classic points, together with new, additional ones, in the lower eyelid brought considerable benefits to patients. The results improved as the skills acquired with practical experience minimized any side effects.

As well as needing additional sites for the application of BoNTA, it was also observed that the presence of subcutaneous cellular tissue in the region and the patient's age are important factors that should be taken into account.

Finally, physicians should inform the patient that, in spite of the application of BoNTA in several points, its isolated use frequently does not eliminate all periorbicular wrinkles, and that the combination of additional procedures to obtain the best possible results is often necessary.

Patients do not always identify or complain about wrinkles in the region where the additional points are located, however, the application of BT in those sites can lead to surprisingly good aesthetic results.

Finally, the clinical pearl is that most wrinkles can be easily treated. Nevertheless, the anatomical dynamics and intrinsic facial mimicry, as well as the presence of subcutaneous fat and the quality of skin and muscle tone may require additional points so that the best results can be achieved.

CONCLUSIONS

The classification of wrinkles allows for a better treatment outcome. In spite of the great benefit brought about by the identification of the classic points, the authors verified the need for treating additional points with BoNTA. The age of the patient and the presence of subcutaneous cellular tissue must also be taken into account. ●

REFERÊNCIAS

1. Draelos ZD. The facial algorithm. *J Cosmet Dermatol*. 2006;5(3):195.
2. Glogau RG. Aesthetic and anatomic analysis of the aging skin. *Semin Cutan Med Surg*. 1996;15(3):134-40.
3. Lemperle G, Holmes RE, Cohen SR, Lemperle SM. A classification of facial wrinkles. *Plast Reconstr Surg*. 2001;108(6):1735-50.
4. Almeida ART, Marques ER, Kadunc BV. Glabellar wrinkles: a pilot study of contraction patterns. *Surg Cosmet Dermatol*. 2010;2(1):23-8.
5. Tamura BM, Odo MY, Chang B, Cucé LC, Flynn TC. Treatment of nasal wrinkles with botulinum toxin. *Dermatol Surg*. 2005;31(3):271-5.
6. Braz AV, Sakuma TH. Patterns of contraction of the frontalis muscle. *Surg Cosmet Dermatol*. 2010;2(3):191-4.
7. Carruthers A, Carruthers J. Botulinum Toxin Type A: History and current cosmetic use in the upper face. *Semin Cutan Med Surg*. 2001;20(2):71-8.
8. Carruthers A, Carruthers J. Clinical indications and injection technique for the cosmetic use of botulinum A exotoxin. *Dermatol Surg*. 1998;24(11):1189-94.
9. Khawaja HA, Perez EH. Botox in Dermatology. *Int J Dermatol*. 2001;40(5):311-17.
10. Pitanguy I, Sbrissa R. Atlas de cirurgia da pálpebra. Rio de Janeiro RJ, Brazil: Colina Livr. Ed; 1994. p. 23.
11. Ferner H, Staubesand J. Sobotta/Becher Atlas de Anatomia Humana. 17ª Ed. Rio de Janeiro: Guanabara Koogan; 1979. p. 169-79.
12. Talarico S, Nascimento M, Begnozzi B. Modified lateral orbital área technique: use of botulinum toxin in radial disposition. A case report. *Cosmetic Botulinum Toxin for the Expert. Symposium. Vancouver, BC*. October 13-14 2000.
13. Kane MAC. Classification of crow feet patterns among Caucasian women: the key to individualizing treatment. *Plast Reconstr Surg*. 2003;112(suppl 5):335-9S.
14. Flynn TC, Carruthers A, Carruthers J. Botulinum-A toxin treatment of the lower eyelid improves infraorbital rhytides and widens the eye. *Dermatol Surg*. 2001;27(8):703-8.