

Clinical Approaches and
Procedures in Cosmetic Dermatology

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REFERENCE

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Botulinum Toxins, Fillers and Related Substances

 Springer

Clinical Approaches and Procedures in Cosmetic Dermatology

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The series “Clinical Approaches and Procedures in Cosmetic Dermatology” intends to be a practical guide in cosmetic dermatology. Procedures in cosmetic dermatology are very popular and useful in medicine, indicated to complement topical and oral treatments not only for photodamaged skin but also for other dermatoses such as acne, rosacea, scars, etc. Also, full-face treatments using peelings, lasers, fillers and toxins are increasingly being used, successfully substituting or postponing the need for plastic surgeries. Altogether, these techniques not only provide immediate results but also help patients to sustain long-term benefits, both preventing/treating dermatological diseases and maintaining a healthy and youthful skin. Throughout this series, different treatments in cosmetic dermatology will be discussed in detail covering the use of many pharmacological groups of cosmeceuticals, the new advances in nutraceuticals and emerging technologies and procedures.

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Bhertha Tamura
Editors

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With 342 Figures and 21 Tables

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Foreword

When I received the invitation from Maria Claudia Almeida Issa (M.D., Ph.D.) and Bhertha Tamura (M.D., Ph.D.) to write one of the chapters of this marvelous book, I was very happy. Later, the mission to write the prologue of this book – whose editors, having to their credit numerous publications in the international scientific field of cosmetic dermatology, dignify the Brazilian dermatology – left me extremely honored. In this book, some of the leading medical doctors and research scientists from Brazil and a few from other parts of the world present their professional experience in the field of cosmetic dermatology.

Cosmetic dermatology is constantly evolving. Procedures for rejuvenating the skin are actively sought by people nowadays. As dermatology grows as a specialty, an increasing proportion of dermatologists will become proficient in performing different procedures. Even those who do not perform cosmetic procedures must be well versed in the details to be able to guide their patients.

There have been numerous major advances in the field of cosmetic dermatology, including the use of botulinum exotoxin, soft tissue augmentation, chemical peels, cutaneous lasers, and light source-based procedures, and the state of the art of dermatologic and cosmetic prescriptions have been developed and enhanced by dermatologists and plastic surgeons.

Botulinum toxin and fillers are routinely used to bring youthful appearance. Over time, a number of indications and different techniques have been developed, promoting even better results. The knowledge of anatomy related to toxin and filler applications is fundamental to achieve good results with safety. This volume covers all these topics and would serve as a good reference for doctors who already handle these procedures and for those who are planning to begin.

The series “Clinical Approaches and Procedures in Cosmetic Dermatology” offers a wonderful and embracing text. It was a pleasure to contribute to this unique book, along with so many renowned authors.

This work project is certainly a text of inestimable value for those who wish to deepen their knowledge in the field of cosmetic dermatology.

Hoping that you will enjoy learning from this book!

Mônica Manela Azulay

Preface

Nowadays, life expectation has increased, and for a better quality of life, people are looking for ways to enhance physical beauty and aesthetics and improve health. Dermatologists and plastic surgeons who work in the field of cosmetic dermatology can help patients to maintain a healthy and youthful skin. Topical and oral treatments associated with full-face procedures using peelings, lasers, fillers, and toxins are increasingly being used, successfully substituting or postponing the need for plastic surgeries.

This series of books is very special among those already published, as it encompasses all topics related to this area of dermatology. All authors are experts in the field of cosmetic dermatology. Literature review and its correlation with authors' experience is a differential feature of this work.

This work has been divided into four volumes due to the breadth of the topics, which cover skin anatomy, histology, and physiology; patients' approaches; common cosmetic dermatosis; topical and oral treatments; and cosmetic procedures.

Among cosmetic procedures, patients recognize botulinum toxin and fillers as those which bring the best satisfaction in short term. In this volume, authors report minutely the use of botulinum toxin, fillers, and collagen biostimulators. They describe the anatomy related to the use of botulinum toxin and fillers, explaining different techniques according to the region to be treated. Indications, contraindications, and management of possible complications are also discussed.

The series "Clinical Approaches and Procedures in Cosmetic Dermatology" was prepared to be a guide in cosmetic dermatology. It can be considered a complete encyclopedia in the field of cosmetic dermatology, and, for this reason, it is extremely useful for those who already work with cosmetic dermatology as well as for beginners in this field. This is a new reference work project, and we are delighted to have you on board.

August 2018
Brazil

Maria Claudia Almeida Issa
Bhertha Tamura

Acknowledgments

When we were invited to write a book on cosmetic dermatology, we could not imagine the dimension of this work project.

After drawing the program content, we realized that a comprehensive handbook series in this field would be built. Nevertheless, it would not be possible without the efforts and experiences of our invited partners. They deserve our acknowledgment and our deep appreciation.

To all collaborators, our very special thanks.

Maria Claudia Almeida Issa
Bhertha Tamura

Contents

| | |
|---|-----------|
| Part I Anatomy View, Indications, Complications, and Management of Botulinum Toxin | 1 |
| Facial Anatomy View for Aesthetic Botulinum Toxin Injection ... | 3 |
| Bhertha Tamura | |
| Botulinum Toxin for Forehead | 11 |
| Beatriz Rosmaninho Caldeira Avé | |
| Botulinum Toxin for Glabella Area and Nose | 17 |
| Bhertha Tamura | |
| Botulinum Toxin for Periorbicular Area | 27 |
| Ana Paula Gomes Meski | |
| Botulinum Toxin for Mentum and Perioral Area | 33 |
| Maria Del Pilar Del Rio Navarrete Biot | |
| Botulinum Toxin for Mandibular Contour | 43 |
| Rodrigo Moraes Ferraz and Julio Cesar Gomes Silveira | |
| Botulinum Toxin on the Neck | 55 |
| Rodrigo Biagioni Ribeiro de Abreu Maia and Adriana Biagioni de Almeida Magalhães Carneiro | |
| Botulinum Toxin for the Décolletage | 61 |
| Bhertha Tamura | |
| Botulinum Toxin for Hyperhidrosis in the Axillary Area | 67 |
| Ada Regina Trindade de Almeida and Suelen Montagner | |
| Botulinum Toxin for Hyperhidrosis in Palmoplantar Area | 77 |
| Eloisa Leis Ayres and Maria Claudia Almeida Issa | |
| Botulinum Toxin for Hyperhidrosis of Uncommon Areas | 87 |
| Érica O. de Monteiro | |
| Microbotox, Mesobotox, Botulinum Toxin Microdroplets | 93 |
| Bhertha Tamura | |

| | |
|---|-----|
| Botulinum Toxin for New Indications | 101 |
| Doris Hexsel, Patricia Caspary, and Carolina Siega | |
| Botulinum Toxin for Migraine | 113 |
| Maria Eduarda Nobre, Marcelo Cedrinho Ciciarelli, and Jano Alves Souza | |
| Botulinum Toxin: Complications and Their Management | 121 |
| Marisa Gonzaga da Cunha, Ana Lúcia Gonzaga da Cunha, and Bhertha Tamura | |
| My Personal Experience with Botulinum Toxin | 135 |
| Mary Sheu | |
| Part II Anatomy View, Indications, Complications, and Management of Fillers and Collagen Stimulators | 145 |
| Facial Anatomy View for Aesthetic Fillers Injections | 147 |
| Bhertha Tamura | |
| Facial Nerve-Block Anesthesia in Cosmetic Dermatology | 177 |
| Flavio Barbosa Luz and Tadeu de Rezende Vergueiro | |
| Hyaluronic Acid Dermal Filler: Physical Properties and Its Indications | 187 |
| Marcelo Neira Ave and Maria Claudia Almeida Issa | |
| Three-Dimensional Approach of Cosmetic Patient: Aging Gracefully | 199 |
| Eliandre C. Palermo, A. Anzai, and A. L. Jacomo | |
| Hyaluronic Acid Fillers: Codifying the Face for Foundation, Reconstruction, and Refinement | 221 |
| Silvia Zimbres | |
| Hyaluronic Acid Filler for Forehead, Temporal, and Periorbicular Regions | 241 |
| Fabiana Braga França Wanick, Diego Cerqueira Alexandre, and Maria Claudia Almeida Issa | |
| Hyaluronic Filler for Nose | 259 |
| Bhertha Tamura | |
| Hyaluronic Acid Filler for the Malar Area | 271 |
| Ricardo Limongi Fernandes | |
| Hyaluronic Acid Filler for the Lips and Perioral Area | 281 |
| Thales Lage Bicalho Bretas, Maria Claudia Almeida Issa, and Bhertha Tamura | |
| Hyaluronic Acid for Mental and Mandibular Contour | 297 |
| Débora T. S. Ormond and Paulo R. Pacola | |

| | |
|--|-----|
| Hyaluronic Acid for Skin Booster on the Face | 311 |
| Sylvia Ypiranga and Rodrigo Fonseca | |
| Hyaluronic Acid for Skinbooster® on the Neck and V Shape Neckline Area | 321 |
| Guilherme Bueno de Oliveira and João Carlos Simão | |
| Calcium Hydroxylapatite to Treat the Face | 327 |
| Gabriela Casabona and Mauricio Shigueru Sato | |
| Calcium Hydroxyapatite to Treat the Hands | 349 |
| Carlos Roberto Antonio and Livia Arroyo Trídico | |
| Poly-L-Lactic Acid for Facial Treatment | 357 |
| Maria Helena Lesqueves Sandoval | |
| Poly-L-Lactic Acid for Body Treatment | 365 |
| Daniel Dal'Asta Coimbra, Betina Stefanello de Oliveira, and Natalia Caballero Uribe | |
| Fillers and Collagen Stimulator for Body Rejuvenation and Cellulitis | 373 |
| Gabriella Correa de Albuquerque | |
| Thread Lifting | 381 |
| Meire Brasil Parada, Samira Yarak, and Daniel Cassiano | |
| Permanent Fillers | 391 |
| Márcio Soares Serra and Leonardo Zacharias Gonçalves | |
| Injectable Soft Tissues with Fibroblasts and Mesenchymal Cells | 399 |
| Neide Kalil Gaspar and Patricia Shu Kurizky | |
| Fillers: Complications and Their Management | 407 |
| Meire Brasil Parada, João Paulo Junqueira Magalhães Afonso, and Nilceo Schwery Michalany | |
| My Personal Experience with Fillers | 423 |
| Maria Claudia Almeida Issa | |
| Index | 435 |

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Dr. Maria Claudia Almeida Issa is among the leading dermatologists in Brazil and Latin America, especially in what regards cosmetic dermatology. Dr. Issa holds a Ph.D. in Dermatology from the Federal University of Rio de Janeiro (2008) and an M.Sc. in Dermatology from the Fluminense Federal University (1997). She is currently an Associate Professor within the Department of Clinical Medicine – Dermatology, at the Fluminense Federal University, Brazil. Her research focuses on photodynamic therapy, non-melanoma skin cancer, lasers, photoaging, and dermal remodeling. Finally, Dr. Issa has an extensive clinical experience in cosmetic dermatology, being registered as a dermatologist at the Brazilian Society of Dermatology since 1995 and member of the American Academy of Dermatology.



Dr. Bhertha Tamura holds M.Sc. and Ph.D. degrees in Dermatology from the Hospital das Clínicas de São Paulo – Universidade de São Paulo. She is a specialist in general surgery and dermatology. She is also a counselor for the Brazilian Society of Dermatologic Surgery and the Brazilian Society of Dermatology, member of the Scientific Commission of the Brazilian Society of Dermatology, Chief of the Department of Dermatology at the Complexo Hospital Heliópolis (São Paulo, Brazil), and member of several international dermatological societies.

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Part I

**Anatomy View, Indications,
Complications, and Management of
Botulinum Toxin**



Facial Anatomy View for Aesthetic Botulinum Toxin Injection

Bhertha Tamura

Contents

| | |
|--|---|
| Introduction | 4 |
| Facial Muscles | 4 |
| <i>Corrugator Supercilii</i> | 5 |
| <i>Procerus</i> Muscle | 5 |
| <i>Orbicularis Oculi</i> | 5 |
| <i>Temporalis</i> Muscle | 6 |
| <i>Pterygoid</i> Muscle | 6 |
| <i>Nasalis</i> and <i>Depressor Septi Nasi</i> | 6 |
| <i>Musculus Levator Labii Superioris Alaeque Nasi</i> | 7 |
| <i>Levator Labii Superioris</i> | 7 |
| <i>Zygomaticus Minor</i> and <i>Major</i> | 8 |
| <i>Musculus Levator Anguli Oris, Levator Labii, and Orbicularis Oris</i> | 8 |
| Buccinator Muscle and Masseter | 9 |

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| | |
|---|----|
| <i>Depressor Anguli Oris (DAO), Depressor Labii, and Mentalis</i> | 9 |
| Take Home Messages | 10 |
| References | 10 |

Abstract

Anatomy has been focused since the first papers of crow's feet and frown lines treated with botulinum toxin (BT). The knowledge and deep understanding of the synergism and antagonism of the muscle contraction still generates a lot of doubts and is essential for an excellent outcome after the injection of BT. We already know that the patients, most of all, are wondering if they will have a natural look after the treatment. Several authors have published the importance of having an individualized analysis in order to achieve great results at absolutely low risk of asymmetries or other complications.

Keywords

Facial anatomy · Botulinum toxin injection · Muscle contraction · Aesthetic

Introduction

If we are chasing a differentiated result for very special patients, it is absolutely imperative that we can classify each muscle, pair of muscle, their location, their action, and their role in the mimics.

There are beauty concept differences between cultures and ethnics, but basically the aim is to get a natural result with a maximum relaxation of the muscles that perpetrates the facial lines. Recently many authors also consider the prophylaxis of the wrinkles when the patients have hyperkinetic movements at specific areas of the facial mimics.

There is not a rule or a standard technique for the injection of botulinum toxin (BT). To reach a natural result, it is necessary to understand facial muscle dynamics.

Facial Muscles

We need to have in mind the synergistic and antagonistic action of the muscle complexes at the face, but first of all, know exactly their location, function, origin, and insertion (Altruda Filho et al. 2005; Gardner et al. 1978; Haddock et al. 2009).

The frontalis and occipitalis venter of the *frontalis* muscle originates at the *galea aponeurotica* of the skull and inserts at the *orbicularis oculi* muscle. At its anterior portion, the muscle divides in pair and is joined by the superficial fascia. This pair can get together at the medial part of the frontal region near the hair implantation; they can extend in different ways, and they are responsible for different patterns of the frontal mimics from one individual to the other changing the botulinum toxin dosage and sites of injection depending on the extension of the muscle. It raises the eyebrows and wrinkles of the frontal area. Figure 1 shows a very good example of the *galea aponeurotica* between the muscle bundles, area that does not need BT injection in patients that have this muscle pattern.

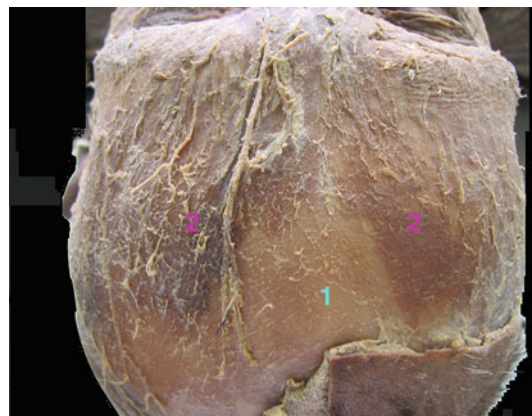


Fig. 1 Figure 1 shows a very good example of the *galea aponeurotica* between the muscle bundles, area that does not need BT injection in patients that have this muscle pattern



Fig. 2 The *corrugator supercilii* pulls the eyebrow together and downward leading to the glabellar hyperkinetic lines – the frown lines

Corrugator Supercilii

The *corrugator supercilii* originates (Gardner et al. 1978) at the internal and anterior orbital margin, superior and medial to the nose, and inserts at the *frontalis* muscle and the superciliary skin. Its contraction pulls the eyebrow together and downward leading to the glabellar hyperkinetic lines – the frown lines (Fig. 2).

They are intimately related to the orbital septum and to the *palpebrae* elevator muscle. And this is the most frequent reason for the lid ptosis after BT treatment near the glabellar area, and this proximity is shown on Fig. 3.

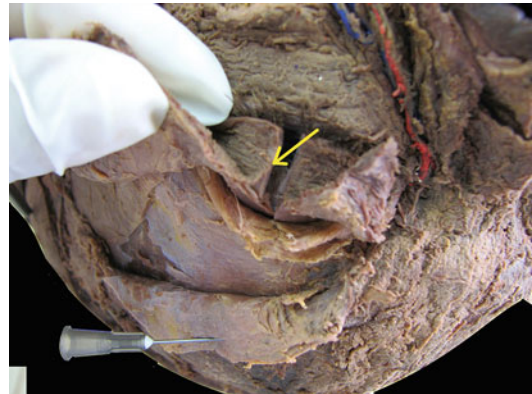


Fig. 3 The corrugator muscles are intimately related to the orbital septum and to the *palpebrae* elevator muscle. The yellow arrow shows the *levator palpebrae* muscle

***Procerus* Muscle**

The *procerus* muscle originates (Haddock et al. 2009) from the nasal bone at the glabella and inserts at the forehead skin. This muscle pulls down the medial part of the eyebrow and is responsible for the horizontal wrinkles at the glabellar area (Fig. 1) and when long or hypertrophic is also responsible for the nasal horizontal lines that are a challenge for the cosmetic treatment.

Orbicularis Oculi

The *orbicularis oculi* muscle (Altruda Filho et al. 2005; Gardner et al. 1978; Haddock et al. 2009; Sobotta and Becher 1977) originates from the palpebral and orbital ligament and joins to the

horizontal fibers of the *nasalis* muscle (Fig. 4) and inserts at the lateral palpebral *raphe*. It is a circular muscle that acts like a sphincter, and it arises from the nasal part of the frontal bone, from the anterior surface and borders of a short fibrous band, and from the frontal process of the maxilla in front of the lacrimal groove. The lateral portion of the *orbicularis oculi* pulls down the eyelid. It is responsible for the closure of the eyelids and the crow's feet lines.

The *orbicularis oculi pars inferior orbitalis* closes the lids and squeezes them against the eye and originates at the lacrimal bone, frontal process of the maxillae, the skin around the orbit and is also responsible for the lower lid lines.

This muscle can be wide in some individuals; it can reach the eyebrow and cover the malar area being responsible of the very long crow's feet lines

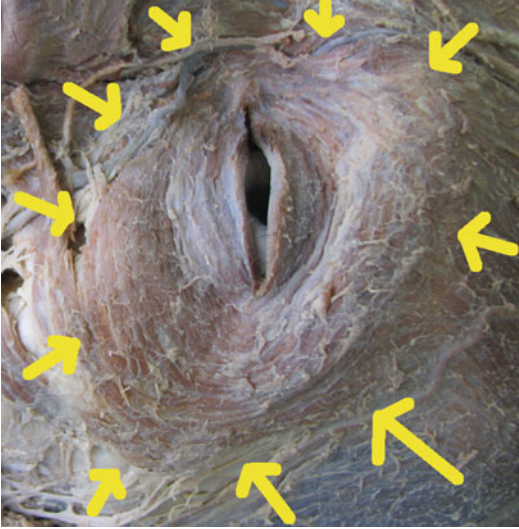


Fig. 4 Orbicularis oculi and its wide distribution around the eyelid

that can go on until the preauricular and also to the inferior temporal area. The perioral and periorbital round muscle acting like a sphincter has a different response to BT; one injection does relax that part of the muscle, not all of it. If we inject botulinum toxin A, for example, it will relax about 1 cm at that location and not the role muscle as a unit.

When we analyze these wrinkles for BT injection, we understand that they need to be treated per area, as at the crow's feet, medial ocular or nasociliary area adding the *procerus* and *nasalis* muscle contraction and lower eyelid lines separately. These lines can also extend inferiorly and laterally until the zygomatic arch and the eyebrow superiorly and medially with a synergetic action of the corrugators.

We need to consider the ocular fad pads (improving or worsening their extrusion), the lymphatic drainage (edema), and the lacrimal gland (dry eyes) as a consequence of an excessive BT injected in too many points or with a high dosage.

Temporalis Muscle

The *temporalis* muscle (Sobotta and Becher 1977) is a mastication muscle, not a mimics muscle. It lies at the temporal fossa, covers the temporal

bone, and is superior to the zygomatic arch. Botulinum toxin to relax this muscle is indicated for patients with bruxism who have hypertrophic masseter added to a temple hypertrophy. BT is also indicated to relax the temporalis muscle for migraine treatment. The temporalis muscle arises from the deep part of the temporal fascia and the temporal *fossa* (superficial layer) passing medially to the zygomatic arch and the deep layer arising from the *sphenoidal tuberculae* and inserting onto the margins and medial side of the *coronoid* process and the temporal crest of the mandible. It elevates and retracts the mandible.

Pterygoid Muscle

The lateral *pterygoid* or external *pterygoid* is a muscle of mastication with two bundles. It lies superiorly to the medial pterygoid. At the lower part of the temporal area we consider the medial and lateral *pterygoid* muscle (superior and inferior bundle). The superior bundle of the *pterygoid* lateral muscle originates from the lateral part of the lateral sheet of the *pterygoid* process and the *facies temporalis alaris majoris ossis sphenoidalis* and inserts at the temporomandibular joint. The inferior bundle originates at the lateral facies of the lateral *pterygoid* plate, pyramidal process of the palatine, and the maxillary tuberosity inserting at the *fovea pterygoidea* (Altruda Filho et al. 2005; Haddock et al. 2009; Sobotta and Becher 1977). The muscle protracts, moves laterally, and stabilizes the articular disc and the opening of the mouth. The medial *pterygoid* muscle originates from the facies lateralis of the *pterygoid* process, *fossa pterygoidea*, and the pyramidal process of the palatine and the maxillary tuberosity inserting at the medial side of the mandible angle and elevates the mandible and acts synergistically with the masseter (Tamura 2010a, b).

Nasalis and Depressor Septi Nasi

At the nasal region, the *nasalis* muscle has two bundles, one that inserts at the nasal *alae* (dilates the nostrils) and the transversal area of the nasal



Fig. 5 At the nasal region, the *nasalis* muscle has two bundles, one that inserts at the nasal *alae 1* (dilates the nostrils) and the transversal area of the nasal dorsum – the dilator *naris* muscle (compress the nostrils) 2 and number 3 is the levator labii superioris *alaeque nasi* muscle

dorsum – the dilator *naris* muscle (compress the nostrils) (Fig. 5). The *depressor septi nasi* (Fig. 6) is a vertical *fasciculus* from the maxilla superior to the central incisor tooth and it passes upward along the median line of the upper lip and inserts into the mobile part of the nasal septum. It interacts with the movement of the nasal tip and the upper lip, shortening the upper lip and depressing the tip of the nose during the smile. We inject BT in the *nasalis* muscle (transverse part) to minimize the bunny lines and in the alar part (dilator *naris*) to control the dilation of the nostrils and the size of the nostrils opening. The injection in the depressor septi nasi muscle softens the wrinkle and retraction of the upper lip, especially concerning the gummy smile with a short vertical length of the upper lip (Tamura 2010a, b).

Musculus Levator Labii Superioris Alaeque Nasi

The levator labii superioris *alaeque nasi* muscle (Fig. 7) elevates the superior lip and the nasal *alae*, helps to dilate the nostrils, originates from the frontal maxillae process, and inserts at the nostrils and the superior lip. The treatment of this muscle is a key point for the success when we are treating the wide and complete gummy



Fig. 6 The *depressor septi nasi* is a vertical *fasciculus* from the maxilla superior to the central incisor tooth, and it passes upward along the median line of the upper lip and inserts into the mobile part of the nasal septum

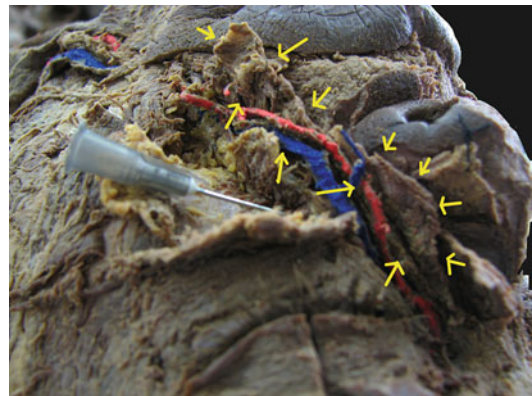


Fig. 7 The levator labii superioris *alaeque nasi* muscle elevates the superior lip and the nasal *alae* and helps to dilate the nostrils

smile that shows the molar teeth. Botulinum toxin injected at this sight smoothens the nasolabial fold. We suggest that the injection site should be at the bundle that inserts at the nostril, medial to an imaginary line between the nasal area and not laterally (Tamura 2010a).

Levator Labii Superioris

The levator labii superioris (Sobotta and Becher 1977) elevates the superior lip and originates at the infraorbital margin of the maxilla foramen inserting to the superior lip. Relaxing this muscle

we treat the gummy smile at the medial part of the superior lip; relaxing it too much leads to patient dissatisfaction, so lower BT dosage injection is advisable

Zygomaticus Minor and Major

The muscle *zygomaticus minor* pulls the upper lip upward and outward and is innervated by the facial nerve (Fig. 8). It originates at the zygomatic bone posterior to the zygomaticomaxillary suture and inserts at the *orbicularis oris* of the upper lip and with the *zygomaticus major* muscle draws the lips corners upward and outward. The *major* originates from the temporal process of the zygomatic bone and inserts at the angle of the mouth (Altruda Filho et al. 2005; Sobotta and Becher 1977; Tamura 2010a, b). It is very important to be precise to not inject in these muscles unless the drop and relaxation of the smile is the aim, for instance, when we want to give symmetry to a patient with facial paralysis.

The *risorius* muscle (Albinus muscle, Santorini muscle) pulls outward and laterally the angle of the mouth lengthening the *rima oris*. *Risorius* muscle originates from the *platysma*, the *masseter*, and the *fascia parotidea* and inserts at the *orbicularis oris* and the skin at the corner of the mouth. *Zygomaticus major* and *minor* as well as *risorius* can be relaxed with BT to soften the

nasolabial fold and the wrinkles on the cheek area. When these muscles are treated certainly the smile will change drastically.

Musculus Levator Anguli Oris, Levator Labii, and Orbicularis Oris

The muscle that elevates the mouth angle is the *levator anguli oris*, which originates from the canine fossa, deeply to the *levator labii*, and inserts at the mouth angle. Around the lips, the *orbicularis oris* (Fig. 9) sits at the mouth *rima*, very superficially and inserts at the skin and the lips mucosa (Altruda Filho et al. 2005; Gardner et al. 1978; Sobotta and Becher 1977). This muscle contracts as a sphincter, and the BT injection does relax only parts of it and not all of it. If we are wondering to treat the upper and the lower lip, injections must be apart and even along the upper lip; mostly injections are made equally one side and the other side. As shown in Fig. 9, we must remember that it is very superficial and thin, though the injections must be also very superficial and near the vermilion of the lip. The superficial injection also avoids relaxing the other muscles of the lower face as the elevators (*zygomaticus major* and *minor*, *levator labii superioris*, *levator labii superioris alaeque nasi* muscle), the *depressors labii* (with *mentalis* muscle), and the mouth angle (*depressor anguli oris* muscle).

Fig. 8 *Musculus Zygomaticus minor and major*

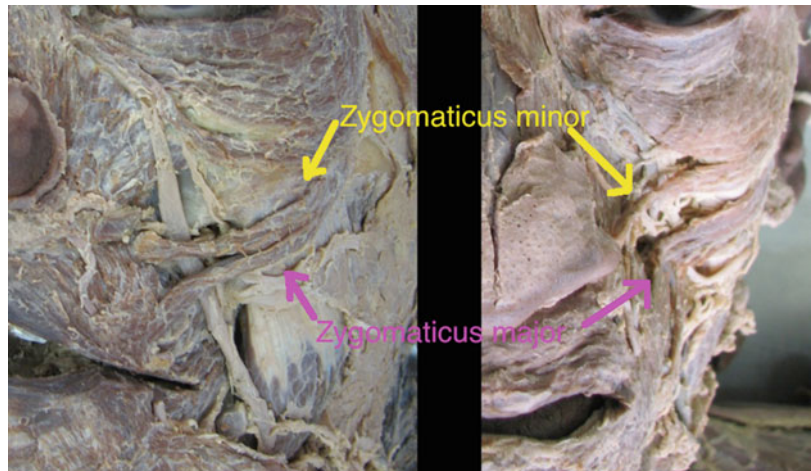




Fig. 9 Around the lips the *orbicularis oris* sits at the mouth *rima*, very superficially and inserts at the skin and the lips mucosa

Buccinator Muscle and Masseter

The cheek muscle, buccinator is located posteriorly to the oral fat and originates from the posterior pterygomandibular *raphe* and the posterior portion of the alveolar portion and inserts at the angle of the mouth, interspersing with portions of the *orbicularis oris* (Altruda Filho et al. 2005; Gardner et al. 1978; Sobotta and Becher 1977). Buccinator flattens the cheek, keeps its tension, retracts the angle of the mouth and is part of the mastication muscle group also helping to suck and whistle. It is intimately related to the tongue and the *orbicularis oris* muscle keeping the food between the teeth and the oral cavity. When BT relaxes this muscle or its paralysis due to a Frey’s syndrome, the food accumulates at the oral vestibule. We need to remember this muscle when treating the masseter with BT to not inject too deep at the buccinator muscle.

Masseter (Fig. 10) lies at the parotideomasseteric area and does have a superficial and a deep bundle. The superficial part originates at the inferior margin of the two-thirds anterior zygomatic arc and the deep portion originates at the internal side of the posterior third and the deep bundle inserts along the lateral branch of the mandible; its main action is to elevate the mandible and is considered as the most powerful muscle of the human body. Understanding masseteric hypertrophy with or without bruxism is a key for the new concept of contouring the lower face.



Fig. 10 Masseter muscle lies at the parotideomasseteric area and does have a superficial and a deep bundle

Depressor Anguli Oris (DAO), Depressor Labii, and Mentalis

The muscular layer of the chin comprehends the *depressor anguli oris*, the *depressor labii*, and the mentalis muscle (Altruda Filho et al. 2005; Gardner et al. 1978; Sobotta and Becher 1977). The origin of the *depressor anguli oris* is the base of the anterior mandible (first molar to the mental tubercle), and it inserts at the mouth angle and other lip muscles. It is the most superficial of the group and the most lateral of the mandible (reference for BT injection) which pulls down the corner of the mouth.

The *depressor labii* originates at the base of the mandible (over to the origin of the *depressor*