

MASSETER MUSCLE HYPERTROPHY IN DENTISTRY

Radostina Vasileva

*Department of Dental Material Science and Propedeutics of Prosthetic Dental Medicine,
Faculty of Dental Medicine, Medical University of Varna*

ABSTRACT

Masseter hypertrophy (MH) is rare, asymptomatic condition with unexplained etiology. The main finding is unilateral or bilateral benign enlargement of masseter muscles, which results in a pronounced contour of the face and/or in the angle of the lower jaw, as well as the occurrence of asymmetry in unilateral hypertrophy.

Surgical resection of the masseter was a conventional method in the past for asymmetric edema treatment above the shoulder and the angle of the lower jaw, after unsuccessful altering of the vertical dimension, dental aligners, tranquilizers, etc. An effective alternative is injecting locally small doses of botulin toxin type A in the masseter. The toxin prevents the release of acetylcholine, causing presynaptic neuromuscular blockage. This way the muscles could be selectively weakened and after local paralysis muscle atrophy is observed. This technique ensures predictable result and it is an alternative conservative method for treating this type facial asymmetry. Another conservative way for treating MH is radio frequency electrocoagulation. The presence of MH after dental treatment requires specialized intervention of specialists and application of contemporary non-invasive interventions with predictable results.

Keywords: *muscle hypertrophy, masseter muscle hypertrophy, craniofacial morphology*

INTRODUCTION

The masseter muscle is one of the four main chewing muscles and is essential in the sufficient chewing process. *M. masseter* is located along the side of *ramus mandibulae* and has a square form. It consists of a superficial and a deep part. The surface part (*pars superficialis*) starts from *os zygomaticum* and from the front end of the *arcus zygomaticus* with thick tendon. It continues in the muscle part

that goes back sideways and connects to *tuberositas masseterica* at *angulus mandibulae*. The deep part of the muscle, *pars profunda*, starts at the inside surface of *arcus zygomaticus* and *fascia temporalis*, continues almost upright under the superficial part and connects to the outside surface of *ramus mandibulae*. Both parts are separated at the back through niche, filled with connective tissue. *M. masseter* is the most powerful lifter of the lower jaw. Thanks to its ideal fiber path from biomechanical point of view it compresses both teeth rows with the help of isometric curtailment of power, equal to the weight of the body. Because of the sideward path of the superficial part, the muscle plays a role in the forward movement of the lower jaw as well. Together with *m. pterygoideus medialis* it comprises the muscle loop around *angulus mandibulae*, in which both muscles work in sync, as they make up for about 55 % of the masticatory pressure.

Address for correspondence:

Radostina Vasileva
Faculty of Dental Medicine
Medical University of Varna
84 Tzar Osvoboditel Blvd
9000 Varna
e-mail: radost11dent@abv.bg

Received: June 3, 2018

Accepted: June 29, 2018

Mm. masseter have an important role in facial esthetics. Enlarged and hypertrophied muscles would change the contour of the face and could have negative esthetic impact. This could lead to potential asymmetry and/or square shape of the face, which is often considered a male feature. Masseter hypertrophy (MH) is a rare benign condition, characterized by asymptomatic enlargement of one or both masseter muscles. The first description was by Legg in 1880, who studied a 10-year-old girl with accompanying idiopathic temporalis muscle hypertrophy (1).

Frequency:

MH is rarely observed, it is observed mainly in the second and third decade of life, and in some article sources there is a lack of gender predisposition. Baek et al. (2), in own research based on 108 cases, report incidence of MH with prevalence in the population over 30 years of age, among which the reported share of bilateral MH is 60% (3,4). It is noted in article sources that this is typical for certain ethnic groups. People of Asian ethnicity are more likely to have it and it is prevailing in men (5,6).

Etiology:

Depending on etiology there are two types of muscle hypertrophy – congenital and acquired due to hyperfunction. Teixeira et al. (7), were the first to classify MH as congenital and acquired due to hyperfunction. There are some theoretical factors about the etiology of MH already described in literature but the exact reason remains unknown. The acquired type is the most common of MH cases and bilateral and symmetrical hypertrophy cases are prevailing while unilateral MH could be seen in patients with unilateral mastication. In most cases MH is related to a bad habit like chewing on one side only due to loss of teeth or pain in some teeth. Other reasons are diseases and temporomandibular joint (TMJ) dysfunctions, bruxism, malocclusion, congenital arteriovenous fistula or focal dystonia. Some authors say that emotional stress and bruxomania could lead to MH. Gurney (8) describes a theory about hypertrophy, which explains that the asymmetrical muscle size development has no relation to the patients' activity.

Clinical Symptoms:

Musculus masseter is one of the most important masticatory muscles located to the side of *ra-*

mus mandibulae and plays an important role in facial esthetics. A common characteristic in MH is the changed contour of the face and this causes discomfort and has negative cosmetic impact on the patients. This is a reason for more noticeable angle of the mandible, changes in facial lines (more square).

DIAGNOSTIC METHODS:

There are conventional methods of diagnosing MH – clinical examination, palpation, photo analysis. Patients complain about pain in the muscles related to TMJ dysfunction syndromes. Some may complain about enlargement of the face and lack of pain. Clinical examination reveals asymmetrical growth over the ramus or mandibular angle, unilateral or bilateral, which is more noticeable during occlusion.

Paraclinical diagnosis of MH by X-ray, ultrasound or computed tomography (CT) scan should be performed to exclude other soft tissue lesions. It is important to exclude the possible differential diagnosis, such as parotid tumors, lymphangiomas, lipomas, benign or malignant muscle tumors and angio tumors. Many authors have described a connection between the square shape of the cross-section of mandibular muscles and facial morphology. Another results is that muscles are larger when patients have “shorter” in frontal facial height and decreased gonial angle. There is often a connection between form and function but it is not clear whether genetically determined facial morphology dictates the power of the muscles or powerful muscles influence the facial form (4,5,6,7).

Management of MH:

Clinically MH is treated only by esthetic complaints. The different types of treatment start from combined muscle or bone removal to botulinum toxin injections. Surgical masseter resection and reduction of bone hyperostosis by means of intra- or extraoral access are conventional treatment methods after unsatisfactory result of occlusal correction, splint therapy, tranquilants, etc. Traditional surgical technique is performed under general anesthesia. The two techniques (intra- and extraoral) are actually a removal of vertical masseter fibers from the internal third of the muscle (9). Reduction osteoplasty could be performed as well. The remaining part of the masseter should be attached to the mandibular peritone-

um to facilitate the healing period. The choice of external or internal incision is not related to cosmetic or functional results, or the surgeon's experience. In the beginning external access was more popular because of the better visualization. The procedure started with submandibular Risdon's incision. Unlike surgical excision of muscle tissue that decreases cell tissue volume, botulinum toxin type A decreases the volume temporarily. Gourney, who performed it in 1947, is considered to be the founder of excision. It includes a submandibular incision and removal of between 1/3 and 3/4 of the muscular tissue – from the aponeurosa to the mandibular border. Removal of tissue by a triangular cut was performed by Martenson on a patient with a history of bruxism with unilateral hypertrophy (10). In 1977, Beckers surgically treated 17 patients using intraoral access and removal of the internal part of the masseter. The internal muscle group is divided from the hypertrophical masseter by entrance in the zygomatic arch until reaching the lower entrance towards mandibular angle. This approach avoids scarring and facial nerve damage (11). Another technique is the removal of bone convexity from the mandibular angle without muscle removal. Complications from masseter removal include hematoma formations, facial nerve injuries, infections, trismus and general anesthesia issues (12).

Application of Botulinum Toxin Type A (BTA):

The first reports of BTA application of part of the MH treatment date back to 1994. A major part of the studies were performed in Asia (13,14,15,16). The efficiency of BTA injections in reducing volume of muscle tissue has been proven by ultrasound, electromyography and 3D scan as well as patient check-ups. The negative part of the BTA therapy is the relatively short effect and it disappears after 6 months (17). Although the BTA technique has shown good results, toxin dosage and place of injection in non-Asian population is still poorly examined. The BTA protein is one of the seven immunologically divided neurotoxins produced by the anaerobic microorganism *Clostridium Botulinum* responsible for the clinical infection called botulism. Local injection of very small amount of the toxin in the muscles produces local paralysis and separate muscles could be selectively weakened with atrophy as a consequence. The toxin prevents acetylcholine production from the

presynaptic vesicles, which causes presynaptic muscle blockage. This method is a very effective alternative of the conventional surgical method and the patients do not suffer side effects. Side effects of BTA injection therapy could be due to deep or wrongly applied injections, temporary paralysis of the nearby muscles but they disappear within 2 to 4 weeks. Possible reactions after treatment are moderate swelling, fever and pain. If the dose is too high muscle weakness could appear and last up to 2 weeks. This kind of treatment provides doctors with a conservative nonsurgical therapy. There are 5 types of BTA available on the market: onabotulinum toxin A (BOTOX, Allergan Inc., Irvine, CA, CAIII), abobotulinum toxin A (Dysport, Ipsen Limited, Wrexham, UK), BTXA (Prosigne, Lanzhou Institute, China), incobotulinum toxin A (Xeomin, Mers Pharmaceuticals, Frankfurt AM Main, Germany), and Neuronox (Medytox Inc., Cheonwon-gun, South Korea) (18,19). In literature some authors try to achieve muscle atrophy by secondary application of the toxin following patient requests but others recommend monthly applications of the toxin until suppressing muscle activity with frequent additional doses to stop the recovery of the muscle force by more than 30%. In regard to the areas of injection there is a tendency to establish a safe area zone after careful clinical examination. This area is relatively small and includes the region from the *angulus oris* to the ear. The frontal end of the masseter muscles are palpable after occlusion. Radiofrequency electrocoagulation is a procedure that uses alternative source of energy causing ionic movement leading to tissue coagulation (60 – 80 °C) for protein denaturation. Although this is a relatively new procedure for treating MH, this technique has been used in medical purposes as an alternative carcinoma treatment. In the end it causes focal necrosis of the masseter muscle, without negative effects, far from the place electricity is applied. The method is poorly studied and documented so that the procedure is a possibility in treating MH but the long-term effects should be examined additionally (20,21,22,23).

CONCLUSION

Despite the low MH incidence in Caucasians, dentists could benefit from the availability of an alternative treatment in mild or moderate MH. The main purpose in the dental field is improving facial

esthetics and reducing masticatory forces. Patients want triangular or heart shaped faces, because of the delicate look. Also nowadays treatment methods try to establish triangular shape that prevails in youth, BTA treatment is a simple technique that could be successful and shows satisfactory results. According to data there is improvement in 100% of the bruxism patients but further researches are necessary. Restricting the smile even with safe area injection is a must inform issue. In extreme cases with MH with facial deformities surgical techniques are indicated. In long term further randomized clinical trials about BTA usage and radiofrequency electrocoagulation should be performed.

REFERENCES:

1. Legg JW. Enlargement of the temporal and masseter muscles on both sides. *Trans Pathol Soc London*. 1880;31:361-66.
2. Smyth AG. Botulinum toxin treatment of bilateral masseteric hypertrophy. *Br J Oral Maxillofac Surg*. 1994; 32(1):29-33.
3. Rispoli DZ, Camargo PM, Pires JL Jr, Fonseca VR, Mandelli KK, Pereira MA. Benign masseter muscle hypertrophy. *Braz J Otorhinolaryngol*. 2008;74(5):790-3.
4. Chandran D, Anupama IV, Balan A, Bose T, Ashish R, Ramachandran S. Unilateral masseteric hypertrophy- report of a case with ultrasonographic justification. *Int J Health Sci Res*. 2016; 6(5): 381-5.
5. Fyfe EC, Kabala J, Guest PG. Magnetic resonance imaging in the diagnosis of asymmetrical bilateral masseteric hypertrophy. *Dentomaxillofac Radiol*. 1999;28(1):52-4. doi: 10.1038/sj.dmfr.4600394.
6. Sannomya EK, Gonçalves M, Cavalcanti MP. Masseter muscle hypertrophy: Case report. *Braz Dent J*. 2006;17(4):347-50
7. Teixeira VC, Mejia JES, Estefano A. Tratamento cirúrgico da hipertrofia benigna do masseter por abordagem intra-oral. *Rev Bras Cir*. 1996;86(4):165-70.
8. Gurney CE. Chronic bilateral benign hypertrophy of the masseter muscle. *Am Surg*. 1947; 73:137.
9. Whitaker L.A., "Prominent mandibular angle: preoperative management, operative technique and results in 42 patients (Discussion)," *Plastic and Reconstructive Surgery*, vol. 83, no. 2, article 279, 1989
10. Martensson G, "Hypertrophy of the masseter muscle," *Acta Otolaryngologica*, vol. 50, pp. 526-530, 1989.
11. Beckers H.L., "Masseteric muscle hypertrophy and its intraoral surgical correction," *Journal of Maxillofacial Surgery*, vol. 5, no. 1, pp. 28-35, 1977.
12. Daniel Z.R., Paulo M.C., Jose M.P., Vinicius R.F., Karina K.M., and Marcela A.C., "Benign masseter muscle hypertrophy," *Revista Brasileira de Otorrinolaringologia*, vol. 74, no.5, pp. 790-793, 2008.
13. Klein FH, Brenner FM, Sato MS, Robert FM, Helmer KA . Lower facial remodeling with botulinum toxin type A for the treatment of masseter hypertrophy. *An Bras Dermatol*. 2014; 89(6): 878-84.
14. Fernanda Homem de Mello de Souza Klein et al. Lower facial remodeling with botulinum toxin type A for the treatment of masseter hypertrophy. *An Bras Dermatol*. 2014 Nov-Dec; 89(6): 878-884.
15. Chang C.S., Bergeron L, Yu C.C., Chen P.K., Chen Y.R. Mandible changes evaluated by computed tomography following Botulinum Toxin A injections in square-faced patients. *Aesthetic Plast Surg*. 2011;35:452-455. [PubMed]
16. Wu W.T. Botox facial slimming/facial sculpting: the role of botulinum toxin-A in the treatment of hypertrophic masseteric muscle and parotid enlargement to narrow the lower facial width. *Facial Plast Surg Clin North Am*. 2010;18:133-140. [PubMed]
17. Peretta R., Melison M., Meneghello R. et al., "Unilateral masseter muscle hypertrophy: morphofunctional analysis of relapse after treatment with botulinum toxin: a case report," *The Journal of Craniomandibular Practice*, vol. 27, no. 3, pp. 200-210, 2009.
18. Kim SB, Ban B, Jung KS, Yang GH. A pharmacodynamic comparison study of different botulinum toxin type a preparations. *Dermatol Surg*. 2013;39:150-154. [PubMed]
19. Baek SM, Kin SS, Bindiger A. The prominent mandibular prospective, management, operative technique and results in patients. *Plast Reconst Surg*. 1989;83:272.

20. Kim N.H, Chung J.H, Park R.H, Park J.B. The use of botulinum toxin type A in aesthetic mandibular contouring. *Plast Reconstr Surg.* 2005;115:919-30.
21. Kim H.J, Yum K.W, Lee S.S, Heo M.S, Seo K. Effects of botulinum toxin type A on bilateral masseteric hypertrophy evaluated with computed tomographic measurement. *Dermatol Surg.* 2003;29:484-9.
22. Yu C.C, Chen P.K, Chen Y.R. Botulinum toxin a for lower facial contouring: a prospective study. *Aesthetic Plast Surg.* 2007;31:445-51.
23. Hu K.S, Kim S.T, Hur M.S, Park J.H, Song W.C, Koh K.S. Topography of the masseter muscle in relation to treatment with botulinum toxin type A. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2010;110:167-71.