

Use of a Questionnaire for Evaluation of Surgical Treatment of Masseter Muscle Hypertrophy: A Case Report

**Luiza Roberta Bin, Mateus Diego Pavelski,
Ana Carolina Fraga Fernandes, Eleanor Álvaro Garbin Junior**

Oral and Maxillofacial Surgery, State University of Western Paraná, Cascavel, Brazil

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Abstract: Masseter hypertrophy (MH) is an uncommon natural condition that affects the facial contour. The etiology is debatable, and complaints are usually cosmetic in nature. The diagnosis is essentially clinical and aided by imaging tests. Treatment is still controversial. The literature is relatively scarce in relation to information on MH, particularly in the evaluation of outcomes. Through questionnaires, the progress was observed in the evaluation of the outcomes of aesthetic procedures. Thus, the purpose of this paper is to apply a Facelift Outcome Evaluation (FOE) questionnaire to evaluate the outcomes of surgical treatment in a case of MH. A 23-year-old male presented to the clinic complaining of bullying due to his facial aesthetics. Clinical and imaging evaluation was performed, with the creation of surgical guides. The patient answered the FOE questionnaire pre- and postoperatively, with results of 12.5 and 100.00 respectively. This subjectively shows the success of the treatment. We suggest that a questionnaire applied exclusively to masseter hypertrophy should be developed, as well as studies for the development of muscle volume measurement protocols, aiming at a more specific evaluation of the surgical outcomes.

Mailing Address: Luiza Roberta Bin, DDS., Oral and Maxillofacial Surgery, State University of Western Paraná, 1619 Universitaria – Universitario, Cascavel, Paraná, 85819-110, Brazil; e-mail: luizarbin@protonmail.com

Introduction

Masseter hypertrophy (MH) is an uncommon natural condition that affects the facial contour (Oliveira et al., 2004; Pereira et al., 2006; Tabrizi et al., 2010; Özkan et al., 2012; Andreishchev et al., 2014; Simão et al., 2014; Trento et al., 2017; Ayhan et al., 2018; Almkhtar and Fabi, 2019) and which may also be referred to as square face syndrome (Rispoli et al., 2008; Özkan et al., 2012; Andreishchev et al., 2014; Trento et al., 2017). Because the masseter muscle plays a key role in facial aesthetics (Xu and Yu, 2013), patients may suffer from psychological issues due to their facial appearance (Tabrizi et al., 2010; Özkan et al., 2012; Ayhan et al., 2018). MH is more common between 20 and 40 years of age, with no difference between genders (Oliveira et al., 2004; Pereira et al., 2006; Bravo et al., 2016; Almkhtar and Fabi, 2019), being more present among Asians and less among Caucasians (Rispoli et al., 2008; Bravo et al., 2016). The etiology is discussed as involving masticatory habits, bruxism, and mandibular retrusion (Oliveira et al., 2004; Pereira et al., 2006; Pary and Pary, 2011; Simão et al., 2014; Almkhtar and Fabi, 2019). It is accepted that, because the masseteric musculature is inserted in the angle of the mandible, it may cause an overdevelopment of this region, due to muscle strength (Rispoli et al., 2008; Pary and Pary, 2011; Andreishchev et al., 2014; Trento et al., 2017; Ayhan et al., 2018). Generally, the patient's complaint is aesthetic (Pereira et al., 2006; Rispoli et al., 2008; Trento et al., 2017; Ayhan et al., 2018), due to asymmetry, when unilateral, or due to a very wide face, when bilateral (Pary and Pary, 2011; Trento et al., 2017; Anehosur et al., 2020). The bilateral condition is more common (Kim and Kameyama, 1992). Unilateral hypertrophy is mainly since 78% of the population has one preferred side in mastication (Almkhtar and Fabi, 2019). Despite being considered an asymptomatic condition, it may be related to bruxism, pain, or functional disorders (Oliveira et al., 2004; Bravo et al., 2016; Ayhan et al., 2018; Almkhtar and Fabi, 2019; Anehosur et al., 2020). The diagnosis is essentially clinical and supported by imaging tests (Pereira et al., 2006; Simão et al., 2014; Trento et al., 2017), such as ultrasonography, computed tomography (CT), three-dimensional reconstruction, and magnetic resonance imaging (Oliveira et al., 2004; Ayhan et al., 2018; Almkhtar and Fabi, 2019; Anehosur et al., 2020). The differential diagnosis involves vascular or glandular tumours and inflammatory diseases, such as myositis ossificans (Rispoli et al., 2008; Özkan et al., 2012; Simão et al., 2014; Trento et al., 2017; Ayhan et al., 2018), which should be considered especially when there is facial asymmetry (Ayhan et al., 2018).

Treatment is controversial (Tabrizi et al., 2010; Özkan et al., 2012; Ayhan et al., 2018) and encompasses two approaches: conservative (Oliveira et al., 2004; Pereira et al., 2006; Kühl et al., 2013; Simão et al., 2014; Bravo et al., 2016; Ayhan et al., 2018; Almkhtar and Fabi, 2019) and surgical (Oliveira et al., 2004; Pereira et al., 2006; Kühl et al., 2013; Trento et al., 2017; Ayhan et al., 2018). Conservative treatment is based on the creation of muscle relaxant plates and the use of muscle relaxants, although they are not as effective (Pereira et al., 2006; Pary and Pary,

2011; Almkhatar and Fabi, 2019). The infiltration of botulinum toxin type A in the medial portion of the muscle – the region with the greatest ramification of the masseteric nerve – can be a safe alternative, as it minimizes muscle contraction by preventing the release of acetylcholine in the synaptic cleft, decreasing muscle activity (Bravo et al., 2016; Almkhatar and Fabi, 2019), being first described in 1994 by Moore and Wood and Smyth (Xu and Yu, 2013; Almkhatar and Fabi, 2019). Nevertheless, it is not a definitive treatment option, as muscle function returns after 3–6 months following application (Pary and Pary, 2011; Bravo et al., 2016; Almkhatar and Fabi, 2019). Surgical treatment was first described by Gurney in 1947 and was based on partial removal of the masseter muscle through an extraoral approach (Kim and Kameyama, 1992; Oliveira et al., 2004; Kim et al., 2005; Rispoli et al., 2008; Tabrizi et al., 2010; Andreishchev et al., 2014; Trento et al., 2017). Wood suggested the resection of the mandibular angle, without manipulation of the masseter, by intraoral access (Tabrizi et al., 2010; Özkan et al., 2012; Ayhan et al., 2018). In 1949, Adams proposed associating partial muscle resection with resection of the mandibular angle (Kim and Kameyama, 1992; Oliveira et al., 2004; Rispoli et al., 2008; Andreishchev et al., 2014). Given the fact that the goal of the treatment is to achieve the aesthetic result, the intraoral access was introduced, avoiding scars and/or nerve damage in the marginal branch of the facial nerve (Andreishchev et al., 2014; Trento et al., 2017; Almkhatar and Fabi, 2019), being described by Converse in 1951 (Kim and Kameyama, 1992; Kim et al., 2005; Andreishchev et al., 2014; Trento et al., 2017). Surgical management is relatively simple, albeit with variable results (Kim et al., 2005). Finally, there is no consensus on which option would be the most suitable for the treatment of MH (Rispoli et al., 2008; Tabrizi et al., 2010; Pary and Pary, 2011; Almkhatar and Fabi, 2019).

The literature is relatively scarce in relation to information on MH (Pary and Pary, 2011; Trento et al., 2017), mainly in the form of evaluation of outcomes (Furlani, 2015). Greater objectivity is needed in the evaluation of outcomes of aesthetic treatments, in which this parameter is subjective (Furlani, 2015). Through questionnaires, an evolution has been observed in the evaluation of the outcomes of these procedures (Furlani, 2015). Questionnaires provide the feedback from patients, which indicate positive or negative outcomes and the degree of the result (Hajcak et al., 2006).

Therefore, the purpose of this paper is to apply a Facelift Outcome Evaluation (FOE) questionnaire to evaluate the outcomes of surgical treatment in a case of MH.

Case report

A 23-year-old male patient was admitted to the oral and maxillofacial surgery department for complaining about his aesthetic appearance and facial width, precisely in the region of the mandibular angles. He reported being the victim of bullying and ridicule for his facial appearance. During physical examination, it was

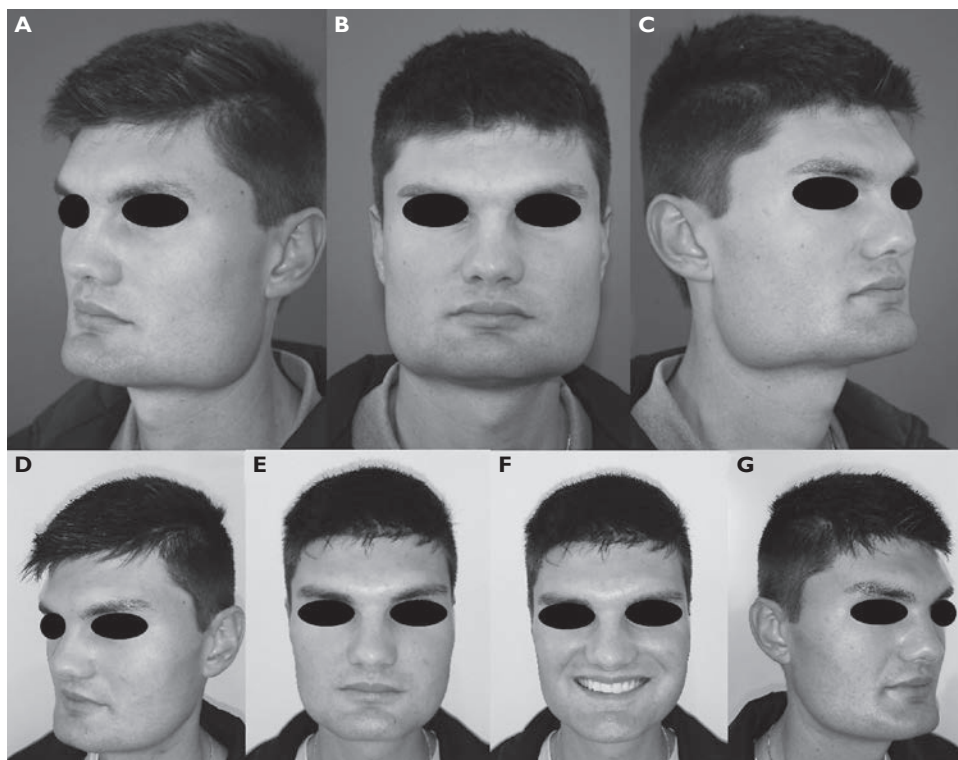


Figure 1 – A) Initial clinical appearance of the patient in $\frac{3}{4}$ left view; B) initial clinical appearance of the patient in frontal view; C) initial clinical appearance of the patient in $\frac{3}{4}$ right view; D) postoperative at 6 months clinical appearance of the patient in $\frac{3}{4}$ left view; E) postoperative at 6 months clinical appearance of the patient in frontal view; F) postoperative at 6 months clinical appearance in smiling frontal view; G) postoperative at 6 months clinical appearance of the patient in $\frac{3}{4}$ right view.

observed that the patient had a slightly class II bite, with acceptable occlusion, absence of excessive tooth wear, and bilateral masseteric swelling (Figure 1A–C). He denied having deleterious or parafunctional habits. In this context, complementary imaging tests were requested to diagnose the swelling.

Panoramic radiography showed a prominent mandibular angle without bone abnormality (Figure 2). On computed tomography of the face, a prominent muscle and bone position was observed in the mandibular angle, also without bone alterations (Figure 3A–C). The diagnosis of masseter hypertrophy was concluded through a combination of clinical and imaging evaluation. Subsequently, following the application of the FOE questionnaire according to the formula $\text{sum of responses}/16 \times 100$, the result $2/16 \times 100 = 12.5$ was found.

The patient was instructed as to conservative treatment option, such as interocclusal device and application of botulinum toxin, in an attempt to reduce



Figure 2 – Initial panoramic radiograph.

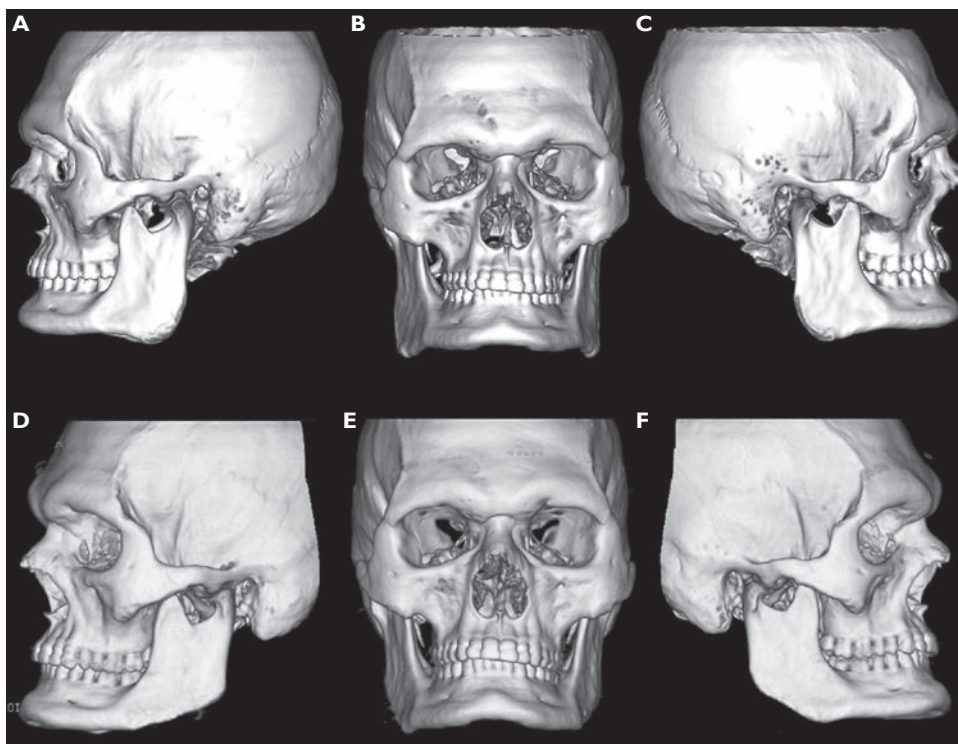


Figure 3 – A) Initial computed tomography in 3D reconstruction of the patient in $\frac{3}{4}$ left view; B) initial computed tomography in 3D reconstruction of the patient in frontal view; C) initial computed tomography in 3D reconstruction of the patient in $\frac{3}{4}$ right view; D) postoperative computed tomography in 3D reconstruction of the patient in $\frac{3}{4}$ left view; E) postoperative computed tomography in 3D reconstruction of the patient in frontal view; F) postoperative computed tomography in 3D reconstruction of the patient in $\frac{3}{4}$ right view.

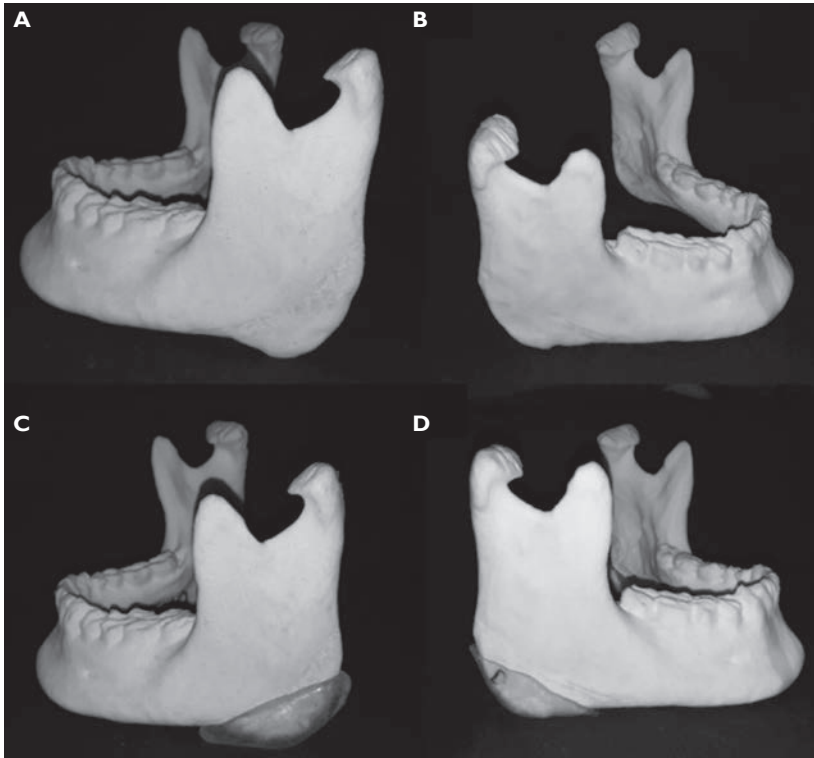


Figure 4 – A) 3D printed model in ¾ left view; B) 3D printed model in ¾ right view; C) left cutting guide positioned in the 3D printed model; D) right cutting guide positioned in the 3D printed model.

muscle strength and cause atrophy of the masseter muscle. Another alternative would be the orthognathic surgery to improve the facial appearance and zygomatic osteotomy. However, the patient chose the mandibular recontour osteotomy and masseter muscle myotomy.

For the surgical planning, a 3D stereolithographic model was made based on computed tomography scan, and osteotomy guides were made with acrylic resin (Figure 4). The procedure was performed under general anesthesia, through a bilateral submandibular access. The regions of the mandibular angles were exposed, and the superficial and deep layers of the masseter muscle were careful dissected. Mandibular osteotomies were performed in the mandibular angle according to the proper position of surgical guides, using a piezoelectric surgery device and 72-fissure burr and grinding burr to smooth the osteotomy edges (Figure 5A–D). For the myotomy, an electrocautery was used during tissue cutting and partial removal of the muscle layer, aiming to minimize bleeding, followed by suturing in layers and dressing (Figure 5E and F).

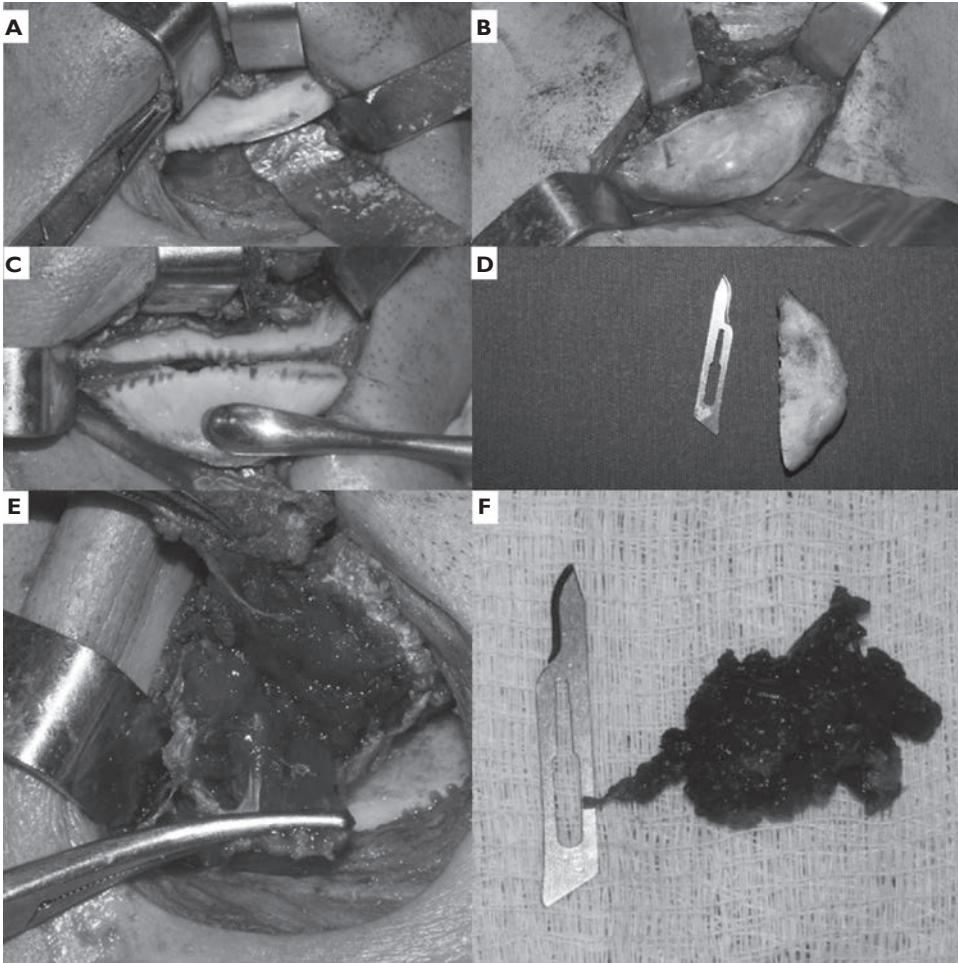


Figure 5 – Trans-operative: A) left mandibular angle exposed; B) left cutting guide positioned in the mandibular angle; C) osteotomy of the mandibular angle and subsequent osteoplasty; D) mandibular angle removed; E) myotomy of the masseter muscle; F) masseter muscle removed.

No complications occurred in the postoperative period. No damage to the marginal nerve of the mandible was seen. After 1 year of surgery, he declares to be satisfied with the result (Figure 1D–G). The satisfaction questionnaire was applied again, and the result was $16/16 \times 100 = 100$. The post operative computed tomography was taken (Figure 3D–F).

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Discussion

There are 10 types of face according to Poch's classification, with the masseter muscle representing a relevant structure in facial aesthetics. For that reason, masseter hypertrophy leads to an unsightly shape, the so-called square face (Andreishchev et al., 2014; Bocchialini et al., 2017). Clinical evaluation is important for diagnosis, as well as panoramic radiography and photographs, to determine the amount of bone to be resected (Kim and Kameyama, 1992). Computed tomography is an excellent tool for more information regarding anatomical structures, but it is not ideal for defining the limits between the buccal and lingual bone wall, which can be achieved via magnetic resonance imaging (MRI) (Kim and Kameyama, 1992). Ultrasonography is able to meet the needs of MRI, being a cheap and quick exam to be performed (Kim and Kameyama, 1992). In the present case, a clinical evaluation was carried out, with photographic documentation, evaluation of panoramic radiography, and computed tomography scan, which was used for three-dimensional printing, impression of the stereolithographic model, and preparation of surgical guides.

The use of imaging mainly helps to exclude pathologies directing the treatment (Pereira et al., 2006; Rispoli et al., 2008; Özkan et al., 2012; Simão et al., 2014; Ayhan et al., 2018). The panoramic view shows the main contraindication for a surgical procedure, which would be the inferior position of the mandibular canal (Andreishchev et al., 2014). Thus, after clinical and imaging evaluation, it was found that, in the present case, the patient did not present bone pathologies, besides that he presented excessive bone structure in the mandibular angles, allowing the surgical procedure. Furthermore, the literature states that, to achieve an ideal aesthetic outcome, partial resection of the masseter muscle and the mandibular angle provides ideal aesthetic results (Ayhan et al., 2018). Thus, as the patient's main complaint was aesthetics, and botulinum toxin A infiltration requires periodic procedures, the patient opted for a definitive treatment.

Given that there is no consensus as to the ideal option for the treatment of MH, the patient's expectations must be considered, in addition to the clinical and imaging assessment (Oliveira et al., 2004; Pary and Pary, 2011; Ayhan et al., 2018). The indication for the use of botulinum toxin as an exclusive treatment involves conditions in which the masseter muscle is well developed, but without bone protrusion, or when there is a large amount of adipose tissue around the chin or zygomatic region (Kim et al., 2005). After complete evaluation, excess bone tissue was observed in the region of the mandibular angle bilaterally, not resulting in the exclusive indication of infiltrating botulinum toxin into the muscle. Another point considered in the choice of treatment was the patient's socioeconomic issue, given that the application of botulinum toxin is necessary at intervals of 6 months, resulting in a high cost for the patient's financial situation.

The number of alternatives for surgical treatment is wide, and the option of resection of the mandibular angle and the lower portion of the masseter with

intraoral access is widespread (Tabrizi et al., 2010; Pary and Pary, 2011; Ayhan et al., 2018). Nevertheless, muscle traction makes visualization for the surgeon, limited access to perform a resection of the ideal amount of the mandibular angle. In such a case, extraoral access would be a more advisable procedure, despite the risk of scarring and nerve injury (Pereira et al., 2006; Pary and Pary, 2011; Ayhan et al., 2018). Other side effects of surgical management would be hemorrhage, hematoma, asymmetric resection (Kim et al., 2005; Xu and Yu, 2013), infection, limitation of mouth opening, and sequelae from general anesthesia (Özkan et al., 2012; Xu and Yu, 2013). Thus, an important step in the resection of the mandibular angle by extraoral access is the correct and symmetrical design of the reference lines for access, as it can guarantee postoperative symmetry (Andreishchev et al., 2014; Ayhan et al., 2018). In the present case, extraoral access was chosen, with demarcations made along Langer's lines, and no trans- or postoperative hemorrhage was observed. The function of the facial expression muscles was maintained, as shown in Figure 1D–G, and facial symmetry was clinically observed (Figure 1D–G). Furthermore, the surgeon's experience is essential for the performance of the surgical procedure (Rispoli et al., 2008; Xu and Yu, 2013), and part of the success of the present case can be attributed to the 20 years of experience of the oral and maxillofacial surgeon who performed the procedure.

Many techniques have been used for the resection of the mandibular angle (Oliveira et al., 2004; Pereira et al., 2006; Andreishchev et al., 2014). It is suggested that osteotomy should be performed with a saw (Andreishchev et al., 2014). In some cases, the use of surgical burrs decreases the precision of the cut due to its lower stability, causing damage to the surrounding soft tissues and leading to an increased chance of bleeding in the trans- and postsurgical period (Andreishchev et al., 2014). Resection of the lingual bone plate from the mandibular angle gives a more delicate result during masticatory movements (Andreishchev et al., 2014). The surgical guide is predictable to the treatment and make the osteotomy as symmetrical as possible in cases of bilateral masseter hypertrophy. It is manufactured through 3D biomodels obtained from computed tomography scan which may have titanium or acrylic resin as its material (Bocchialini et al., 2017; Trento et al., 2017). The use of this artifice is valuable, considering that the main complaint of patients in masseter hypertrophy involves facial aesthetics, as in the present case. The guide material used in the report was acrylic resin, aiming to reduce cost to the patient, maintaining the treatment.

Satisfactory aesthetic results require additional surgical procedures such as the resection of the buccal fat pad to emphasize the narrowing of the lower third of the face, as its location contributes to the contour of the lower third of the face (Oliveira et al., 2004; Xu and Yu, 2013; Andreishchev et al., 2014). In this case the most conservative treatment possible was chosen, and thus, the buccal fat pad was maintained.

After osteotomy, muscle volume decreases with time, due to the decrease in muscle tone (Kim et al., 2005; Pary and Pary, 2011). The masseter volume can be estimated

by the muscle thickness in several CT slices (Yu et al., 2007; Andreishchev et al., 2014; Almukhtar and Fabi, 2019). The literature shows that this measurement was performed in patients who received botulinum toxin application (Almukhtar and Fabi, 2019). Despite being an exam indicated for the evaluation, we did not find articles that compared the volume of the masseter muscle in a quantitative way. Thus, it is suggested that studies be carried out to develop protocols for measuring muscle volume and to offer an even more thorough assessment for cases of masseter muscle hypertrophy.

The masseter muscle plays a key role in aesthetics and facial shape (Xu and Yu, 2013), and the shape of the face can influence judgments, made in a brief time of personal contact, influencing attitudes and quality of life (Yu et al., 2014; Todorov et al., 2015). Physical characteristics are part of what the human being observes in the other person to form and maintain their social relationships (Yu et al., 2014; Todorov et al., 2015). The literature shows that facial features can influence the interpretation and reaction that people have towards someone, as well as influencing decisions and social behavior (May, 1996; Yu et al., 2014; Todorov et al., 2015). A crucial point is the confidence that facial expression can convey (May, 1996; Yu et al., 2014; Todorov et al., 2015), which may even influence necessary characteristics at work, such as leadership skills or how competent an employee is (Yu et al., 2014). When a patient is bullied for their appearance, they may show nervous and angry expressions, which, in particular, negatively influences social relationships (May, 1996). It is already demonstrated in the literature that feedback from the environment influences the success of an individual's actions, and research has deepened the studies in relation to this topic (Hajcak et al., 2006), as well as in relation to facial expression and how it influences the trust of social interactions (Yu et al., 2014; Todorov et al., 2015). Therefore, with the awareness of the patient's initial complaint of being a victim of bullying in his job, the fact of a positive result in the treatment, with an adequate aesthetic appearance, directed the patient to the normal return of his daily activities, which we can consider a success in the treatment.

There is no specific questionnaire for surgical treatment in MH, so the choice of the Facelift Outcome Evaluation questionnaire was based on the fact that, according to the literature, it has already been tested in relation to its validity, reliability, and response capacity, being a reliable quantitative tool for measuring results (Furlani, 2015). This questionnaire was translated from English into Portuguese and adapted by Furlani (2015) for the evaluation of rhytidoplasty, its application taking about 1 minute. Because it is a questionnaire aimed at facial aesthetics in general, small adaptations were necessary to make it viable for its application with MH patients. Two questions were excluded, as they referred solely to wrinkles, and the formula required a few adjustments. We observed that the response evolved from 12.5 in the preoperative period to 100 in the postoperative period, which is the maximum satisfaction value. This demonstrates the positive result of the procedure. There are other questionnaires aimed at assessing facial aesthetics, including more complete

ones, such as the Face-Q (Furlani, 2015), but the only complaint of the patient was in relation to the lower third of the face, which led us to apply the FOE. We suggest, however, that a questionnaire be developed exclusively for application to masseter hypertrophy.

Conclusion

Finally, it is important to consider the patient opinion when performing aesthetic procedures. The application of the adapted Facelift Outcome Evaluation questionnaire subjectively showed the positive result of the treatment. We suggest that a questionnaire applied exclusively to masseter hypertrophy should be developed, in addition to studies to develop muscle volume measurement protocols, for a more specific evaluation of the surgical result.

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