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Masseteric Hypertrophy: Considerations Regarding Treatment Planning Decisions and Introduction of a Novel Surgical Technique

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Masseteric hypertrophy is considered an enlargement of the masseter muscle volume involving one or both sides of the face.[1-3] Frequently, it is also associated with hypertrophy of other masticatory muscles, such as temporalis hypertrophy.[3]

Yet, several theories have been proposed regarding the etiology of masseteric hypertrophy, and its specific cause has not been well clarified.[2]

The affected patients frequently exhibit an increase in volume and height in mandibular ramus resulting in well-defined mandibular angles. In bilateral cases, one side is usually more compromised than the other; thus facial asymmetry may be a common feature. Patients exhibit a brachycephalic facial pattern frequently associated with deep-bite Class II malocclusion. Muscular pain and limited mouth opening are common features.[2,4]

On radiographic examination, an enlargement is frequently noted on mandibular angles, which can be attributed to the bone response to muscular hyperactivity stimulation. On the posteroanterior view, an abnormal lateral projection on the mandibular angle called a bone spur can be seen over the insertion of the masseteric muscle.[2,4]

The traditional treatment involves a partial surgical resection of the masseteric muscle and/or mandibular angles that can be done by an intraoral or extraoral approach.[5] The intraoral approach is preferable because it avoids injury to the facial nerve and conspicuous scars.[2,4] However, when compared with the extraoral approach, it is related to more difficulty in removing great proportions of muscle and bone in an accurate and symmetric manner.[2,6,7] Inaccurate surgery results in resection of different proportions between each side, resulting in an asymmetric facial deformity. The extraoral approach has been described as preferable when large resections have to be done.[5,6]

Conservative treatment modalities such as botulinum toxin type A injection[1,3,7-10] and radiofrequency coagulation[11,12] have recently been introduced and yielded good outcomes. However, there is no consensus or protocol by which to decide when surgical or conservative treatment is indicated.

The aim of this report is to describe a novel surgical technique, performed by an intraoral approach, promoting a large resection of a muscle and bone segment in an accurate and safe manner, in the treatment of a severe manifestation of masseteric hypertrophy. The purpose was also to discuss which factors must be considered in the election of surgical versus conservative treatment. A case of severe masseteric and temporalis bilateral hypertrophy treated with the described technique in the masseteric region and botulinum toxin type A in the temporal component will illustrate the technique, and we will discuss the indication criteria used for this treatment (Figs 1-3).

Masseter Total Exposure: Surgical Technique

Our technique is indicated in severe cases of masseteric hypertrophy in which it is necessary to remove a large amount of muscle and bone by an intraoral approach.

1. An initial incision is performed with a scalpel in the mucosa and submucosa, 5 mm lateral to the mandibular vestibule, extending from the first molar to the half height of the mandibular ramus.
2. Once the buccinator muscle is exposed, it is transected with a sharp dissection that is directed medially toward the anterior board of the mandibular ramus.
3. After the exposure of the anterior board of the mandibular ramus, dissection of the anterior

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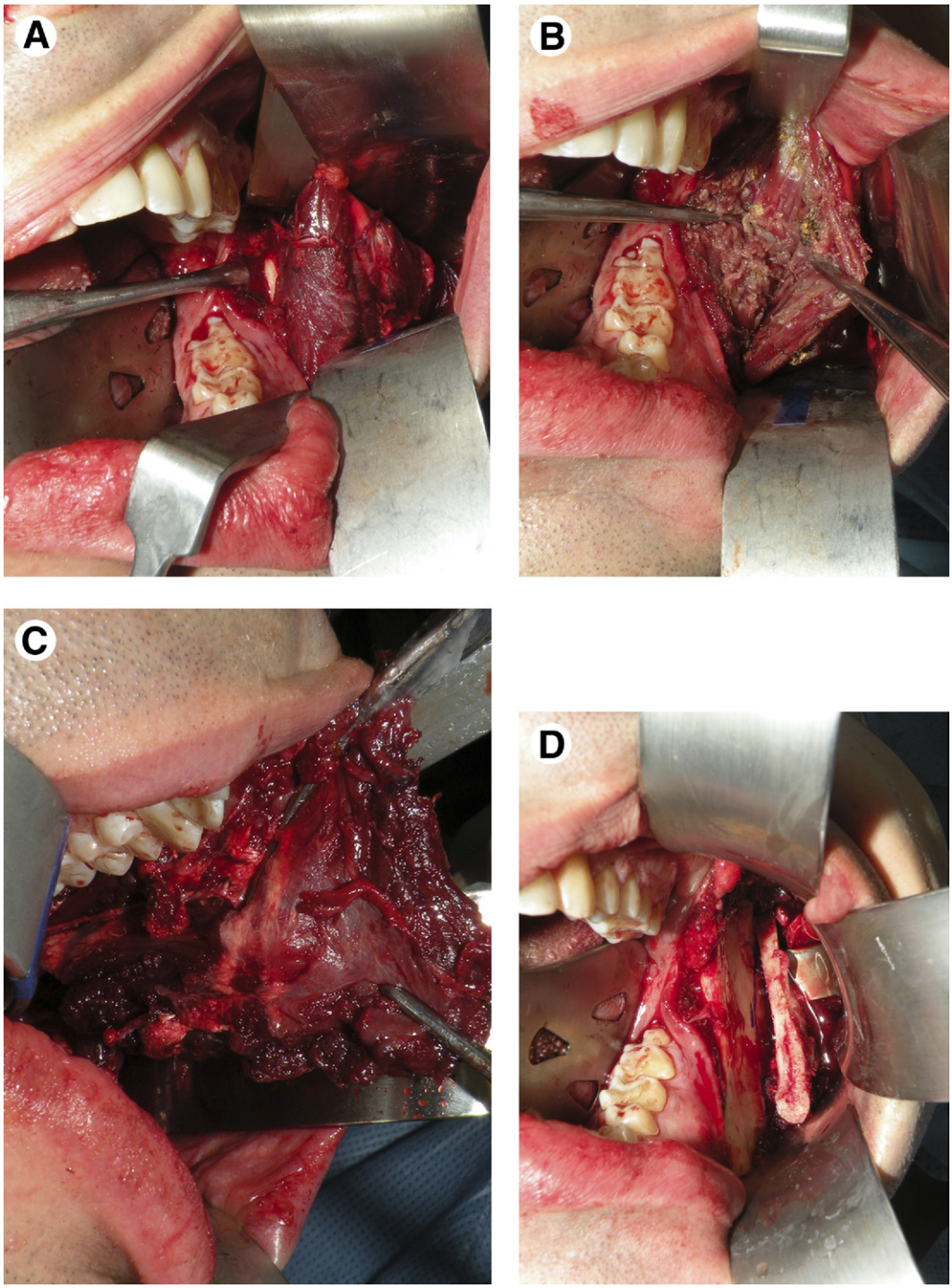

FIGURE 1. Masseter total exposure technique. *A*, The masseter muscle is totally exposed on its lateral and medial aspects by an intraoral approach, giving the surgeon a better perception of the transverse and anteroposterior dimensions of the muscle. *B*, The masseter muscle is divided into deep and superficial portions. The deep portion width is determined by the surgeon according to the severity of the muscle hypertrophy. *C*, The deep portion of the muscle is resected. *D*, The resected bone segment from the other side is used as a template to resect the same amount of bone.

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surface of the masseter muscle with Metzenbaum scissors or a periosteal elevator follows. When the lateral surface of the masseter muscle becomes visible, on the plane of its fascia, the retractors and instruments are removed and the dissection is performed with the index finger of the surgeon. The dissection of the lateral surface is performed in the masseteric

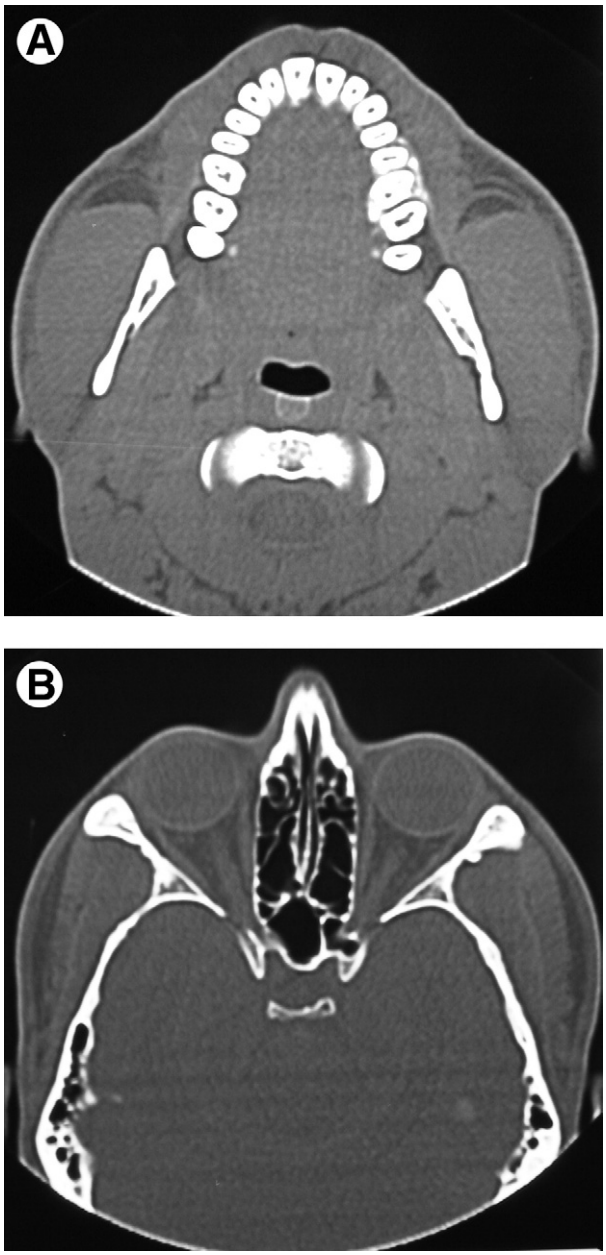

FIGURE 2. Computed tomography images. *A*, Axial view showing masseter muscles with severe enlargement of the transverse dimension. *B*, Axial view showing enlargement of temporalis muscles.

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fascia plane, with splitting of the fascia from the superficial aponeurotic muscle system. Dissection with the finger avoids injury to the facial nerve, permits visualization of the dissection boundaries from an extraoral view, and is easy to accomplish.

4. After the lateral dissection of the masseter muscle, the medial surface is also detached from the mandibular ramus with the index finger of the surgeon.
5. With the entire muscle exposed, the surgeon can have a real perception of the transverse dimension of the muscle and split it in a more desirable manner. So, the muscle is divided in the superficial and deep portions, via electrocautery. As the dissection proceeds, a malleable retractor can be used to retract the superficial portion and facilitate the dissection. The muscle is divided in its entire extension, and consequently, the deep portion is removed, the amount of which varies based on the severity of the deformity.
6. To treat the osseous deformity, Bauer retractors are placed in the inferior board of the mandible and at the sigmoid notch, and the Merrill-Lavassier retractor is placed in the posterior board of mandibular ramus, retracting the superficial portion of the muscle laterally.
7. The ostectomy of the mandibular angle can be done by use of burs or a reciprocating saw, but we recommend an oscillating saw. The ostectomy is done in a triangle-shaped design initiating at the inferior board and continuing toward the posterior board.
8. Before completion of the osteotomy, while there still is 5 mm of intact bone between the posterior board of the mandibular angle and the osteotomy, the mandibular angle is retracted laterally and the medial pterygoid muscle is detached. This prevents medial displacement of the mandibular angle caused by pterygoid muscle traction.
9. The resected bone segment is preserved to be used as a template to guide the design of the osteotomy on the opposite side. This prevents unequal resections between the 2 sides, which would result in facial asymmetry.
10. The same technique is used on the other side, but it must be stressed that the osteotomy design will be done based on the bone template removed from the first operated side.
11. Finally, an active drain is inserted on both sides through the intraoral wound and transfixed to the skin in the submandibular region. The drain is fixated with sutures, and a compressive bandage aid is placed and maintained for 3 days. This prevents dead space creation, hematoma development, and postoperative infection, which are usually related to this procedure.

Case Report

The patient was a 27-year-old man who was referred for evaluation of a bilateral symmetric enlargement of mandibular ramus. The patient's chief complaint was his square-shaped face.

FIGURE 3. Preoperative and postoperative clinical photographs. *A*, Frontal aspect in preoperative period. *B*, Frontal aspect in postoperative period. *C*, Profile clinical photograph in preoperative period. *D*, Profile photograph 3 months after surgical intervention and 2 months after botulinum toxin type A injection in temporal muscles.

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On clinical examination, bilateral and symmetric expansion was noted in the temporal and masseteric regions with a soft consistency on palpation, resulting in a square-shaped face. The malocclusion pattern was deepbite Class II.

The patient denied any painful symptomatology and indicated that the facial aspect was present since puberty and no change had been experienced. He also denied parafunctional habits such as clenching, bruxism, or nail biting.

The diagnostic hypothesis was severe idiopathic masseteric and temporal bilateral hypertrophy.

Imaging examination showed a prominent bone in the mandibular ramus region and an expressive enlargement in the masseteric and temporalis muscles on both sides. The diagnosis of idiopathic masseteric and temporal bilateral hypertrophy was confirmed.

Deep partial resection of the masseteric muscle associated with osteoplastic ostectomy of the mandibular ramus was proposed. Surgery was performed by use of the described technique.

No complications occurred in the postoperative period. There was no transient or permanent injuries to the facial nerve.

For temporal hypertrophy, botulinum toxin type A injection was used 30 days after the surgery. The used technique was described by von Lindern et al.[9] Only 1 application was necessary.

The patient was seen at 12 months' follow-up after surgery showing good facial harmony and esthetics. At present, there has been no need for botulinum toxin reapplication.

Discussion

The treatment modalities for masseteric hypertrophy include the traditional surgical treatment and conservative treatment, with the latter being constituted by botulinum toxin type A injection or radiofrequency coagulation. However, the literature lacks a discussion about which factors must be used in the decision about which treatment must be instituted.

The first factor that we consider important in the treatment decision is the severity of the hypertrophy. A study conducted by Kim et al[8] evaluated the effects of botulinum toxin type A regarding muscle volume reduction after injection and showed a mean reduction of 22% in relation to initial volume, varying from 8.1% to 35.4%. Furthermore, surgical treatment can reduce up to two thirds or more of the total volume and botulinum toxin injection can reduce only one third in its maximum response.[13] Therefore botulinum toxin injection must be considered only when there is no need for a great amount of volume reduction. Therefore, for severe cases, surgical treatment is indicated.

The second important criterion we used is the presence or absence of bone involvement. Because masseteric hypertrophy is frequently present during skeleton facial development, the mandibular angles, which are the muscle attachment regions, suffer greater stimulation due to muscle hyperactivity resulting in vertical, lateral, and horizontal enlargement.[5] Both botulinum toxin injection and radiofrequency electrocoagulation act only on the muscular component of the deformity, resulting in a limited outcome if there is an associated bone deformity. On the other hand, surgical treatment can manage both muscular and osseous components.[5]

Finally, it is important to discuss the longevity and predictability of the treatment. Although botulinum toxin injection has presented results with a longevity of 2.5 years with 1 or 2 applications for some cases,[9] it is important to comment that the temporary pharmacologic effects of botulinum toxin type A have a mean duration of 3 months and recurrence is expected to occur 6 months after the injection. Several authors have already shown that after this period, repeated injections may be necessary.[1,3,7-11]

Although radiofrequency electrocoagulation is considered a definitive option, more studies must be conducted to evaluate potential side effects, complications, and predictability of long-term results, as well as to define the mean amount of muscle volume reduction.[10,11]

In our patient we chose surgical treatment of masseteric hypertrophy because of the severity of the deformity and the desire of the patient to undergo more predictable and definitive treatment. For temporal hypertrophy, botulinum toxin type A injection was indicated because the muscle enlargement was only moderate. Furthermore, the patient's complaints were not so significant regarding the temporal regions, and he chose conservative treatment when the advantages and disadvantages of both treatments were explained.

Regarding surgical technique, the intraoral approach is preferable because it avoids facial nerve damage and unesthetic bilateral scars that stigmatize the patient. However, given the technical difficulty and limited exposure, several authors recommend the extraoral approach when large resections have to be performed.[5,6] In this report we describe a technique for accurate and symmetric large resections involving the masseter muscle and mandibular angle using the intraoral approach. We consider the total dissection of masseter muscle indispensable in terms of visualization, precision, and safety of surgical resection. The total exposure of the masseter muscle offers a good reference for the depth of the resection, avoiding risks of facial nerve injury. Thus the dissection of the lateral aspect of the masseter muscle is necessary. For this, we recommend blunt dissection at the plane of the masseteric fascia using the index finger. The index finger avoids nerve injury and also makes the exposure easier, eliminating the necessity for dissection with long instruments and permitting a good reference for the extension of undermining because of tactile sensibility.

It is important to stress that the described technique is indicated only when a great decrease in the overall muscle volume, such as in severe cases of masseteric hypertrophy, is necessary. For mild manifestations, we recommend only bone resection on the mandibular angle because it induces muscular atrophy in the 6 months after surgery.[14]

Different amounts of bone resection between both sides usually result in facial asymmetry. Almeida et al[15] have described a technique in which a surgical splint is manufactured based on radiographic examination to avoid unequal resections. In the described technique, the resected bone on 1 side is used as a guide to perform the ostectomy on the other side. This makes the procedure simpler, avoiding the need to fabricate an acrylic surgical splint before surgery.

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