

Use of Ultrasonography and Face Scan in the Follow-up of Masseter Hypertrophy Management: Two Cases

Masseter Hipertrofisi Tedavisinin Takibinde Ultrasonografi ve Yüz Tarama Kullanımı: İki Olgu

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ABSTRACT Bruxism is a parafunctional activity and over time it leads to hypertrophy of masseter muscles which can cause a square appearance of face profile and myofascial pain as well. There are surgical and non-surgical methods to treat the masseter hypertrophy. Botulinum toxin injection into the muscle is a safe and effective non-surgical method in the management of hypertrophy. It is also important to monitor the region of interest by one imaging method such as magnetic resonance imaging (MRI), computed tomography (CT), ultrasonography (USG) or face scan. Aim of this case report is to demonstrate the effectiveness of USG and face scan procedures in the follow-up of masseter hypertrophy treatment by Botulinum toxin type-A injection.

Keywords: Bruxism; ultrasonography; face scan

ÖZET Bruksizm, parafonksiyonel bir aktivitedir ve zamanla masseter kaslarının hipertrofisine yol açarak, yüz profilinde kare görünüme ve miyofasiyal ağrıya neden olur. Masseter hipertrofisini tedavi etmek için cerrahi ve cerrahi olmayan yöntemler vardır. Kas içine Botulinum toksini enjeksiyonu, hipertrofi tedavisinde güvenli ve etkili bir cerrahi olmayan yöntemdir. İlgilenilen bölgeyi manyetik rezonans görüntüleme (MRG), bilgisayarlı tomografi (BT), ultrasonografi (USG) veya yüz taraması gibi bir görüntüleme yöntemiyle izlemek de önemlidir. Bu olgu sunumunun amacı, USG ve yüz tarama prosedürlerinin, Botulinum toksin tip-A enjeksiyonu ile yapılan masseter hipertrofisi tedavisinin izlenmesinde etkinliğini göstermektir.

Anahtar Kelimeler: Diş gıcırdatma; ultrasonografi; yüz tarama

Bruxism is a parafunctional activity and its diagnosis is completed through physical and imaging examinations. Over time, chronic clenching leads to hypertrophy of masseters causing a square appearance of face profile because of swelling that can be seen in the angular mandibular region of the face. Masseter muscle hypertrophy can be unilateral or bilateral but most commonly on the dominant side.^{1,2} The etiology of masseter hypertrophy includes several factors like emotional stress, chronic bruxism, masseteric hyperfunction, and parafunction.³⁻⁵ Muscle tumors, salivary gland disorders, and intrinsic masseter myopathy must be taken into account in dif-

ferential diagnosis. Therefore, it is important to take an intensive clinical history and conducting physical examination as well as monitoring the region of interest by one of the several imaging methods such as magnetic resonance imaging (MRI), computed tomography (CT) or ultrasonography (USG). Also, changes in masseter muscles during the management of hypertrophy can be monitored and measured easily via ultrasonography and face scan of CBCT devices.

Correction procedures of masseter hypertrophy are often requested for esthetic reasons due to altered face profile. There are surgical and non-surgical meth-

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ods that have been used to treat the condition.⁶ Botulinum toxin injection is a non-surgical method and have a high efficacy and safety profile in the management of hypertrophy.⁴ Botulinum toxin type A (BoNT-A) is a toxin that is produced by *Clostridium botulinum* bacteria, it causes temporary muscle paralysis and atrophy by blocking acetylcholine secretion in neuromuscular junctions.⁷ Alternatively, muscle relaxants and occlusal splints have been used to fix slight cases. Furthermore, surgical interventions like reduction of the masseter muscle and osteotomy are the other options in the treatment of masseter hypertrophy.⁶ Aim of this case report is to demonstrate the effectiveness of USG and face scan procedures in the follow-up of masseter hypertrophy treatment by BoNT-A injection.

CASE REPORTS

CASE 1

A 27 years old female patient was referred to dentomaxillofacial radiology department due to aesthetic complaints of square facial profile. Patient's history showed that she have had clenching and moderate pain in the mornings. There was tenderness to palpation of masseter region and evident swelling in clinical examination. The patient underwent USG examination to differentiate possible reasons. There were not any tumors or other disorders that may cause swelling except masseter hypertrophy in the examination. Informed consent was taken before the examination. Masseter muscle was monitored bilaterally and thickness of muscles were measured

from 3 different regions (anterior border, thickest central region and posterior border) in clenching and resting positions on USG images (Figure 1). Average of measurements were obtained. Subsequently, the patient was also monitored by face scan of CBCT device (Planmeca, ProFace 3Dmax, Finland) to follow up of the changes in face profile during treatment (Figure 2). BoNT-A injection was planned for the treatment of masseter hypertrophy. After the first injection, the patient was called for control one month later. Both USG and face scan monitoring was performed in the control session and it was decided to inject second dose of botulinum toxin. Four months after the second injection, the patient was monitored again and the obtained data was recorded. It was concluded that tenderness of masseter region was healed, but, there was not an evident change in face profile according to measurements of USG and face scan images (Figure 3). It was interpreted that this may have resulted from the continued parafunction of the patient.

CASE 2

A 50 years old female patient was referred to the hospital with esthetic complaints of facial asymmetry. Besides, she had complaints of severe pain while clenching especially in the morning. Informed consent was taken before the examination. Medical history and clinical examination showed bilateral masseter hypertrophy associated with bruxism. Ultrasonographic findings supported the diagnosis, and the patient was monitored by using face scan procedure of CBCT device as in the first case. BoNT-A was

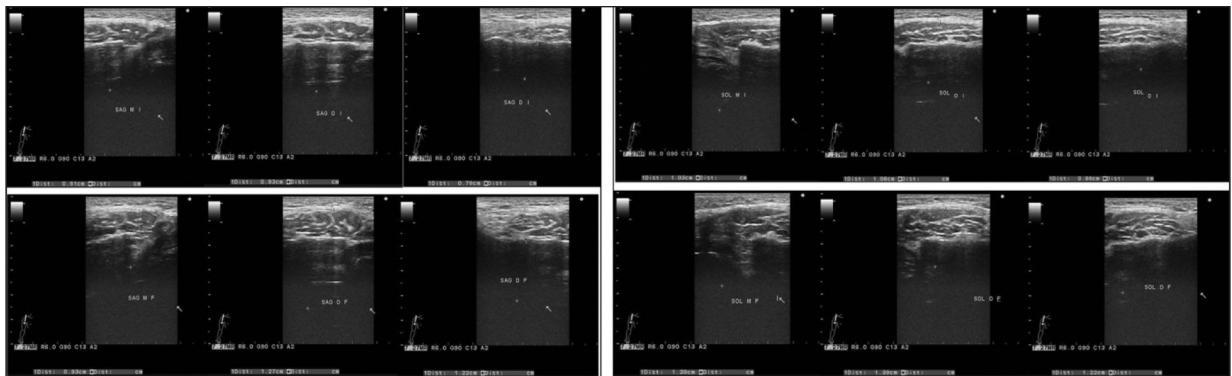


FIGURE 1: Initial USG examination of bilateral masseter muscles with thickness measurements in 3 different regions (anterior border, thickest central region and posterior border) in both rest and clenching positions.



FIGURE 2: Initial and one month follow-up face scans of case 1.

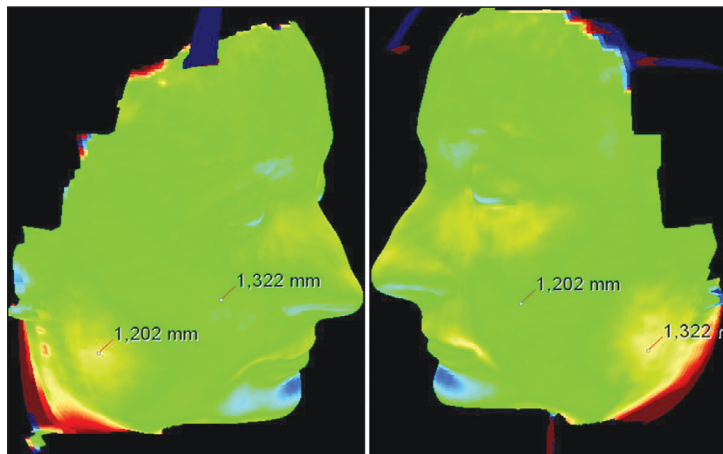


FIGURE 3: Deviation map of initial-one month follow-up face scan fitting.

injected to manage the muscle hypertrophy. Masseter thickness was measured with ultrasonography before the first injection and in every visit to control or applying maintenance dose if necessary, as well as the patient was monitored with face scan to follow the changes of face profile (Figures 4, Figure 5, Figure 6).

Table 1 shows the USG findings of the patients before and during the treatment. Reduction in the masseter muscle thickness was detected in both cases. But, still there was an assymetry between the left and

right masseter muscles in Case 1. Thickness of left masseter muscle was not reduced up to right side. A symmetrical reduction of masseter muscle thickness was found in Case 2 on USG measurements.

Table 2 shows the face scan fitting findings of 2 cases. Face scan fittings was performed between control scans and initial scans by using the software of CBCT device (Planmeca Romexis). Thus, slimming in both sides of patients' face profile of Case 2 was detected in mm's. Slimming in face profile was detected to be more as compared to Case 1.

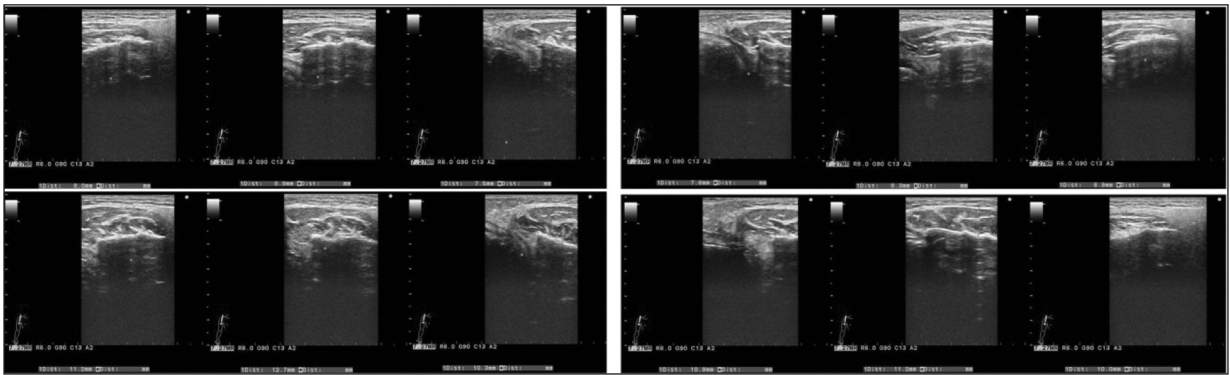


FIGURE 4: Initial USG examination of bilateral masseter muscles with thickness measurements in 3 different regions (anterior border, thickest central region and posterior border) in both rest and clenching positions.



FIGURE 5: Initial, 1 month, 2 months and 6 months follow-up face scans of case 2.

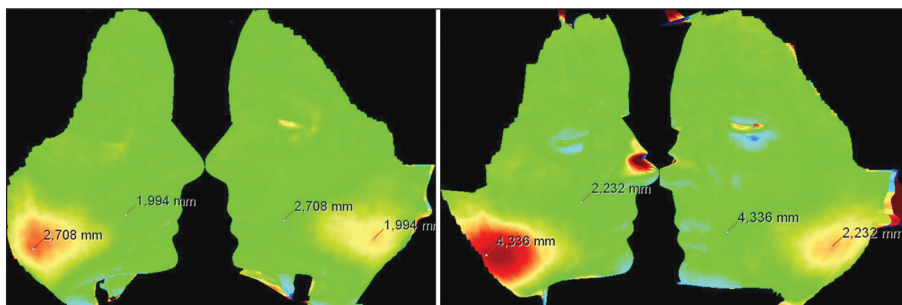


FIGURE 6: Deviation maps of initial-one month and initial-6 months follow-up face scans fittings.

DISCUSSION

Masseter muscle hypertrophy can be developed based on parafunctional activity such as bruxism, excessive

gum chewing, or certain dietary habits.⁸ It can cause severe morphological changes in face contour and cosmetic disfigurement.^{9,10} Surgical interventions including gonial angle reduction and masseter my-

TABLE 1: Masseter muscle measurements of the patients before and during the treatment on USG images.

Unit: mm's	Patient 1 right	Patient 1 left	Patient 2 right	Patient 2 left
initial USG in rest	8,4	10,23	8,13	7,6
initial USG in clenchnig	11,4	13,3	11,4	10,7
1 month follow-up in rest	9,6	7,87	8,7	8,6
1 month follow-up in clenchnig	11,97	9,83	11,57	11,37
2 months follow-up in rest	7,21	8,3	6,6	6,33
2 months follow-up in clenchnig	9,52	10,12	8,13	7,5
6 months follow-up in rest	6,77	9,07	6,77	5,33
6 months follow-up in clenchnig	9,93	13,23	8	6,63

omectomy have been performed as standart procedure to solve the patients' cosmetic complaints in the past.¹¹ BoNT-A injection into the hypertrophic masseter muscle have been started to use as a standart minimally invasive procedure instead of surgical procedure with the same outcome to surgery in recent years.^{1,12-16} Therefore, BoNT-A injection was selected as a minimally invasive method to treat patients' complaints in this case series.

BoNT-A is a neurotoxin of Clostridium botulinum bacteria, it induces masseter muscle paralysis and causes muscle atrophy by blocking acetylcholine secretion in neuromuscular junctions.⁷ Finally, BoNT-A injection ends up with lower face slimming due to reduction of masseter muscle thickness. All of the cases in this case series had complaint of lower face enlargement. So, BoNT-A injection was used as a choice of masseter muscle hypertrophy treatment resulting with lower face slimming.

Several quantitative methods are used to measure the changes in facial contours and masseter muscle dimensions include facial photography, magnetic resonance imaging, computed tomography and ultrasonography.^{1,17,18} Ultrasonographic measurements have some disadvantages such as it only provides 2-dimensional images and it is difficult to provide the

exact position of probe in different time frames.⁸ However, it is a non-invasive, user-friendly and less expensive imaging method when compared with others. Face scan is a kind of facial photography which is provided by CBCT device and it is also a non-invasive and user-friendly method used to follow the facial changes as well. It can be used to evaluate pre-operative diagnosis, postoperative evaluation, symmetry analysis, and so on.¹⁹ There are some in-vitro and in-vivo studies that evaluate the accuracy of the face scan method to determine the accuracy in length and angle measurements.²⁰⁻²³ But all the methods used in these studies only represent the metric measurements and do not represent the 3-dimensional shape of the face. The method used in the present study is based on fitting of pre-op and post-op face scan images by using the the software of CBCT device (Planmeca Romexis). So, the image of the whole face was obtained in each scan and facial images obtained at different times were made comparable, also, 3-dimensional shape of the face could be determined. Therefore, both ultrasonography and face scan were used to follow the results of BoNT-A injection to treat the masseter hypertrophy of patients. It was seen that both of the methods can provide clinically significant data and the clinician can decide whether to continue treatment.

TABLE 2: Face scan fitting findings of 2 cases. Face scan fittings was performed between control scans and initial scans.

Unit: mm's	Patient 1 right	Patient 1 left	Patient 2 right	Patient 2 left
initial-1 month face scan fitting	1,2	1,32	2,71	1,99
initial-2 months face scan fitting	1,52	1,44	3,71	2,66
initial-6 months face scan fitting	1,7	1,88	4,34	2,23

There are a lot of studies determining the efficacy of BoNT-A injection to decrease the masseter muscle thickness in the literature.²⁴⁻²⁹ The methods used for measuring amount of decrease are USG to measure the thickness, CT or CBCT to measure the volume of muscle and clinical examination. The results of these studies reported the average decrease of muscle thickness as about 3-38% of preinjection thickness. Similarly, in this case report, muscle thickness decrease at rest was found as 19.4% in the left and 11.3% in the right for the first patient, 16.7% in the left and 29.9% in the right for the second patient as measured by USG. Also, in accordance with USG measurements, results of face scan fittings between initial and 6-months follow up show the decrease in the lower face contour for both patients.

Ultrasonography is a useful tool in the diagnosis of masseter hypertrophy related with bruxism. Also, it is very helpful to measure the thickness of masseter muscle in the follow-up. Due to the effect of botulinum toxin injection into masseter muscle over face profile, combination of face scan and ultra-

sonography is very helpful to follow the changes of masseter thickness and face profile during treatment.

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Conflict of Interest

No conflicts of interest between the authors and/or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Kaan Orhan; **Design:** Hakan Eren, Nilsun Bağış; **Control/Supervision:** Hakan Eren, Nilsun Bağış; **Data Collection and/or Processing:** Hakan Eren, Nilsun Bağış; **Analysis and/or Interpretation:** Kaan Orhan, Hakan Eren; **Literature Review:** Hakan Eren, Nilsun Bağış; **Writing the Article:** Hakan Eren, Nilsun Bağış; **Critical Review:** Nilsun Bağış, Kaan Orhan; **References and Fundings:** Nilsun Bağış, Hakan Eren; **Materials:** Nilsun Bağış.

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