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Research / Araştırma Makalesi

How do Mandibular Osteotomies with and without Le Fort I osteotomy affect the Mentolabial Groove from the frontal view?

Le Fort I Osteotomisi ile Kombine veya İzole Mandibular osteotomiler önden bakıldığında Mentolabial Oluğu nasıl etkiler?

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ABSTRACT

Purpose: The aim of this study was to determine how the mentolabial groove at the frontal view is affected by mandibular osteotomies.

Materials & Methods: Sixty-two patients were appointed into two groups (Group 1: Class II skeletal deformity, Group 2: Class III skeletal deformity). In each patient, pre and postoperative standardized sixth-month photos (lateral and frontal view) were obtained in natural head position to investigate mentolabial groove length (MGL), mentolabial groove depth (MGD), mentolabial groove angle (MGA) and mentolabial angle (MLA).

Results: Out of the 62 patients, 41 had Class III skeletal deformity (66.2%) and 21 Class II skeletal deformity (33.8%). In Group 1, the average ratio of MGL decreased significantly from 0.59±0.14 to 0.45±0.09 ($p<0.001$). Contrary to Group 1, the ratio of MGL increased significantly from 0.41±0.11 to 0.50±0.13 in Group 2 ($p=0.001$). There was a negative correlation between MGA and MGL ($p=0.001$, $r=-0.439$). MGD positively correlated with MGL ($p<0.001$, $r=0.499$).

Conclusion: After orthognathic surgery, the mentolabial groove decreases in class II patients and increases in class III patients. Orthognathic surgery significantly affects mentolabial anatomy and therefore should be planned carefully to obtain an aesthetic appearance in the mentolabial region.

Keywords: mentolabial groove, orthognathic surgery, frontal view

ÖZ

Amaç: Bu çalışmanın amacı ön cepheden bakıldığında mentolabial oluğun mandibular cerrahiden nasıl etkilendiğini belirlemektir.

Gereç ve Yöntem: Altmış iki hasta iki gruba ayrıldı (Grup 1: Sınıf II İskelet Deformite, Grup 2: Sınıf III İskelet Deformite). Her hastada mentolabial oluk uzunluğu (MGL), mentolabial oluk derinliği (MGD), mentolabial oluk açısı (MGA) ve mentolabial açıyı değerlendirmek için doğal baş pozisyonunda ameliyat öncesi ve sonrası standardize altıncı ay fotoğrafları (yan ve ön görünüm) alındı (MLA).

Bulgular: 62 hastanın 41'inde Sınıf III iskelet deformit (%66.2) ve 21'inde Sınıf II iskelet deformitesi (%33.8) vardı. Grup 1'de ortalama MGL oranı 0,59±0,14'ten 0,45±0,09'a anlamlı derecede azaldı ($p<0,001$). Grup 1'in aksine, Grup 2'de MGL oranı 0,41±0,11'den 0,50±0,13'e anlamlı olarak arttı ($p=0,001$). MGA ile MGL arasında negatif korelasyon vardı ($p=0.001$, $r=-0.439$). MGD, MGL ile pozitif korelasyon gösterdi ($p<0.001$, $r=0.499$).

Sonuç: Ortognatik cerrahi, mentolabial anatomiyi önemli ölçüde etkiler ve bu nedenle mentolabial bölgede estetik bir görünüm elde etmek için dikkatli bir şekilde planlama yapılmalıdır.

Anahtar Kelimeler: mentolabial oluk, ortognatik cerrahi, Frontal görünüm

INTRODUCTION

The mentolabial sulcus, defined as the mentolabial groove at the frontal view, plays an essential role in lower lip movement and facial expression.[1-4] The mentolabial groove is more prominent in individuals with a short face, while individuals with longer faces have an obscure groove.[1,3,5] A deep mentolabial fold may be more attractive in patients with increased lower anterior face height (LAFH), as the fold's presence deemphasizes the lower face's height. On the contrary, a shallow fold is desired in short-face individuals as a deep fold would make the face appear even shorter.[3] The mentolabial groove, whether deep or shallow, is not aesthetically pleasing, so when planning orthognathic surgery, it is important to consider potential postoperative changes in this area.

Following orthognathic surgery, changes in the mentolabial soft tissue morphology are related to several variables, including muscle attachment, lower incisor inclination, lower lip thickness, and chin position. Studies about soft tissue changes in the mentolabial region following orthognathic surgery have been based on the profile view.[6-8] The frontal view is also important during social interaction, such as communication and smiling. Therefore, the mentolabial region after orthognathic surgery should also be assessed with a frontal view. To our knowledge, no study has evaluated the effect of orthognathic surgery on the aesthetics of this region in frontal view.

This study aimed to evaluate the effect of orthognathic surgery on the mentolabial groove from both a frontal and profile view and to determine how soft tissue changes in these two views affect each other.

Material and Methods

The Ethics Committee approved this study (Istanbul Medipol University Institutional Review Board and Ethics Committee-Ethical approval no:401) in compliance with the Declaration of Helsinki.

Patients with dentofacial deformity who underwent mandibular osteotomies with and without Le Fort I osteotomy by the same surgical team between August 2018 and February 2021 at the Istanbul Medipol University School of Dentistry, Department of Oral & Maxillofacial Surgery were evaluated.

Patients were enrolled if they had undergone isolated bilateral sagittal split ramus osteotomy (BSSRO) or bimaxillary surgery with or without genioplasty and if their medical records included at least six months of follow-up and postoperative photographs. Patients with a history of mandibular trauma, temporomandibular ankylosis, face and/or neck pathology, congenital deformities like cleft lip and palate, soft tissue surgeries, mandibular asymmetry patients whose lower incisor angles are not prepared in the end position, and patients with incomplete records were excluded from the study.

The patients were divided into two groups according to mandibular advancement (Group 1) and setback (Group 2) surgery. In each patient, lateral and frontal photographs were taken before and six months after surgery in a standardized manner, which was obtained in natural head position using a single digital camera (Nikon, Tokyo, Japan) mounted with a 105 mm macro lens with a 1.5 meters distance at the eye level. The patients were instructed to relax their necks, shoulders, and mouth to achieve the neutral head position. Also, they were instructed to look straight into the camera's lens while photographs were taken.

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Linear measurements were compared as proportions. The proportion between mentolabial groove length and intercanthal distance was determined in a frontal view. The proportional relation of mentolabial sulcus depth to the distance between lateral canthus and nasion point was also determined in the profile view. Pre and postoperative proportional measurements were made by the same clinician (MS) using Image J software (version1.5i; National Institutes of Health, Bethesda, MD, USA):

The following landmarks and reference lines were used for the measurements (**Fig 1**)

A1, the most right point of mentolabial groove (MG) at frontal view

A2, the most left point of MG at frontal view

C, the superior point of MG at frontal view

B, the deepest point of MG at lateral view

Li, labial inferior, the most anterior point of the lower lip

Pg, Pogonion, the most anterior point of the chin

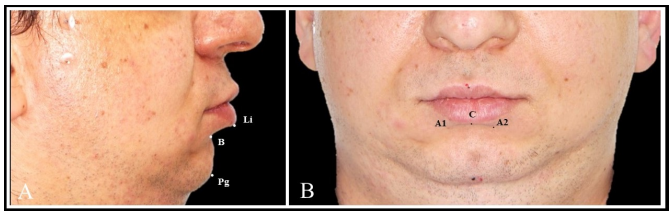

Figure 1. A) Lateral view; B: the deepest point of MG, **Li:** labial inferior, the most anterior point of the lower lip, **Pg:** Pogonion, the most anterior point of the chin **B) Fronral view; A_1:** the most right point of mentolabial groove (MG), **A_2:** the most left point of MG, **C:** the superior point of MG

The following parameters were investigated: (**Fig 2**)

Mentolabial Groove Length (MGL): The linear distance between the most right and left points of the mentolabial Groove (frontal view)

Mentolabial Groove Angle (MGA): The angle between the lines is drawn from the most superior point of MG to the most right and the most left point of the MG (frontal view).

Mentolabial Angle (MLA): The angle between the deepest point of MG and the labial inferior (Li) and the deepest point of MG and the pogonion (lateral view)

Mentolabial Groove Depth (MGD): Distance of the deepest point of MG to the line passing between the labial inferior (Li) and pogonion (lateral view)

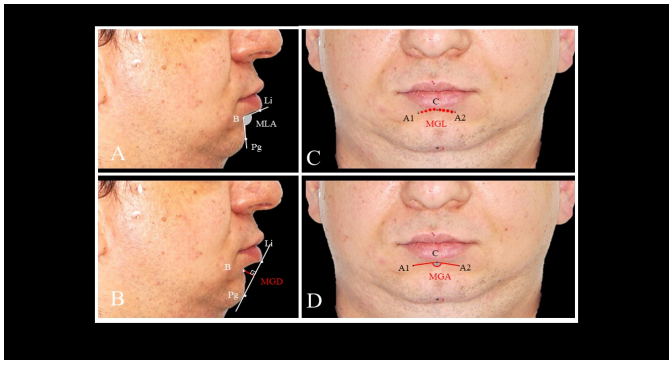

Figure 2. A) Lateral view; MGD: Distance of the deepest point of MG to the line passing between labial inferior (Li) and pogonion, **B) MLA:** The angle between the deepest point of MG and labial inferior (Li), and the deepest point of MG and the pogonion **C) Frontal view; MGA:** Angle between a line passing through the right most point of mentolabial groove (MG) and the superior point of MG and other line passing between theleft most point of MG and the superior point of MG **D) MGL:** The lineer distance between the most right and left point of mentolabial Groove

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp, Armonk, NY, USA). Paired sample t-test was used to determine the differences between pre and postoperative soft tissue values. Investigated soft tissue correlations were calculated by the Pearson correlation test (P <0.05).

Results

Of the 113 patients, 62 met the inclusion criteria. Out of the 62 (49 female-13 male), 41 patients had Class III skeletal deformity (66.2) and 21 Class II skeletal deformity (33.8%). The mean age was 25.2±5.7 years (range, 17-43). **Tables 1** and 2 presented the mean and standard deviation results of angular and linear soft tissue measurements for Group 1 and Group 2 at pre and postoperative periods.

Table 1. Mean values of the pre and postoperative measurements of investigated soft tissue landmarks

Measurements		Group 1(n=21) Class II			Group 2(n=41) Class III		
		Pre- op Mean±SD	Post-op Mean±SD	p value	Pre- op Mean±SD	Post-op Mean±SD	p value
Frontal view	MGL	0.59±0.14	0.45±0.09	0.000*	0.41±0.11	0.50±0.13	0.001
	MGA	162.07±9.05	163.3±9.36	0.564	159.58±25.55	156.24±12.44	0.414
Profile view	MGD	0.27±0.06	0.23±0.46	0.002*	0.22±0.06	0.23±0.05	0.144
	MLA	115.22±21.03	119.59±18.35	0.143	133.71±14.88	128.65±12.26	0.010*

Abbreviations: SD, standard deviation
Paired Student's t-test
**p<0.05*

In Group 1, the average ratio of MGL was 0.59±0.14 for the preoperative period and 0.45±0.09 for the postoperative period. There was a significant difference between these values (p<0.01). MGD ratio was decreased significantly from 0.27±0.006 to 0.23±0.46 (p=0.002). MGA was increased from 162.07±9.050 to 163.3±9.360. This difference was not significant. MLA was increased from 115.22 ±21.030 to 119.590±18.350. This difference was also insignificant. (**Fig.3**)

Figure 3. Pre- and postoperative images of class II patients.

Contrary to the findings in Group 2, the ratio of MGL increased significantly from 0.41±0.11 to 0.50±0.13 in Group 2 (p=0.001). However, MGD was not changed significantly(p=0.144). MLA decreased significantly from 133.71±14.88 to 128.65±12.26(p=0.010). MGA was decreased from 159.58±25.550 to 156.24±12.440. This difference was not significant. (**Fig.4**)

Figure 4. Pre- and postoperative images of class III patients.

When group 1 and group 2 were compared, there were significant differences in MGL, MGA, and MGD between groups ($p<0.05$). There was a negative correlation between MGA and MGL ($p=0.001$, $r=-0.439$). MGD correlated with MGL ($p<0.001$, $r=0.499$).

Table 2. Mean difference, standard deviation and p- value of pre and postoperative measurements for Group 1 and Group 2

Measurements	Group 1(n=21)	Group 2(n=41)	p value
	Dif. Mean±SD	Dif. Mean±SD	
MGL	-0.13±0.14	0.086±0.15	0.000*
MGA (Frontal)	1.25±9.56	-3.33±25.1	0.008*
MGD	-0.03±0.04	0.015±0.06	0.002*
MGA(Profile)	4.36±13.13	-5.06±11.85	0.01*

*Abbreviations: SD, standard deviation, Dif. =Difference between pre and postoprative period, *significant*

Discussion

The mentolabial region has an essential role in the cosmetic appearance of the lower face.[9] This study evaluated how the mentolabial groove changes in patients with skeletal Class II and Class III deformity following orthognathic surgery. The length of the mentolabial groove is decreased in patients with skeletal Class II deformity, while the length of this groove is increased in patients with Class III deformity. In addition, an inverse correlation was found between MGA and MGL. It can be concluded from these results that in cases with an increased mentolabial groove length, the mentolabial groove angle is decreased, and an unaesthetic appearance may be observed following procedures. Careful preoperative clinical examination of the mentolabial region of patients scheduled for orthognathic surgery may help to avoid unfavorable aesthetic outcomes.

The most desirable mentolabial angle was determined to be between 107° and 118°, with a range of up to 140° being considered acceptable. Angles outside this range, specifically anything below 98° or over 162°, are considered unappealing. The least appealing mentolabial angles were those that were deep (84°) or nearly flat (162°).[1] In the present study, the preoperative mentolabial angle was 115 degrees in patients with skeletal class II deformities; there was an increase at this angle after orthognathic surgery, but in patients with class III deformities, this angle was 133 degrees at the beginning, and it was decreased after orthognathic surgery.

Studies on the mentolabial angle have shown that the mentolabial fold becomes more concave after mandibular setback surgery. It has been suggested that the increase in the depth of the mentolabial fold is due to the decrease in soft tissue thickness in this region and the normalization of perioral muscle function.[10-12] Cheng et al. reported that a 9.4 mm setback and 5.1 mm superior movement in the mandible increased the mentolabial depth from 3.4 mm to 4.7 mm, and the mentolabial angle decreased from 153.4 degrees to 136.9 degrees.[5] Similar to this study, Mobarak et al. reported an increase of approximately 0.4 mm in mentolabial depth with the mandibular setback.[10] Tiwari et al. reported a decrease of 3.27 degrees in the mentolabial angle after each 1mm mandibular setback. An increase of 7.6 degrees per 1 mm after 2 to 4 mm advancement and 3.6 degrees increase in mandibular advancement of 1 mm after 4 to 8 mm.[6] When the findings in our study were evaluated, there was a statistically significant decrease in the mentolabial depth after the mandibular advancement procedure performed on patients with Class II skeletal deformities. A tendency to increase was observed in the mentolabial angle, although it was not statistically significant. As a result of the mandibular setback procedure performed in Class III patients, there was a decrease in the mentolabial angle but no change in the mentolabial depth.

It is crucial to evaluate the mentolabial region, as it is an essential aesthetic factor, especially from the frontal aspect. Aesthetics of the mentolabial region after orthognathic surgery were investigated from the profile in all the studies mentioned above. This study assessed how angle and depth in the sagittal plane affect the mentolabial groove in the facial plane. The patient's soft tissue characteristics do not always reflect the complete movements of the jaws following orthognathic surgery, sometimes resulting in an undesirable profile. Thus, more research is needed to assess changes in the mentolabial groove while also considering soft tissue thickness. The mentolabial sulcus, as well as other facial measurements such as tooth shapes, facial height and width, eyes, nose, and jaw relations, all play a role in determining whether a face is appealing or unappealing. The results of this study could not be compared to the literature because there is no study evaluating the mentolabial groove from the frontal aspect.

Conclusion

After mandibular osteotomies with and without Le Fort I osteotomy, the mentolabial groove decreases in class II patients and increases in class III patients. Considering these results, orthognathic surgery planning should be carefully made to achieve an aesthetic mentolabial groove in the lower face region.

Patient consent: Written consent was obtained from the patients

Ethical approval: Ethical approval was given by the Istanbul Medipol University Institutional Review Board and Ethics Committee (Ethics approval no: 401).

Değerlendirme / Peer-Review

İki Dış Hakem / Çift Taraflı Körleme

Etik Beyan / Ethical statement

This research were presented as oral presentation at the “15th ACBİD International Oral & Maxillofacial Surgery Society Congress” held in Antalya between 11-15 May, 2022.

Bu araştırma 11-15 Mayıs 2022 tarihlerinde Antalya'da düzenlenen “15th ACBID International Oral & Maxillofacial Surgery Society Congress”te sözlü bildiri olarak sunulmuştur.

It is declared that during the preparation process of this study, scientific and ethical principles were followed and all the studies benefited are stated in the bibliography.

Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur.

Benzerlik Taraması / Similarity scan

Yapıldı - ithenticate

Etik Bildirim / Ethical statement

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Çıkar Çatışması / Conflict of Interest

Yazarlar çıkar çatışması bildirmemiştir. | The authors have no conflict of interest to declare.

Yazar Katkıları / Author Contributions

MS (% 50) and SU (%50) conceived this study. MS (%100) collected the data. MS(%35), ED(%35), AO (%30) participated in the design and coordination of the study. MS (%30), ED (%25), AO(%25), SU (%20) drafted the manuscript. MS(%35), ED(%35), AO (%20), SU (%10) interpreted the findings and edited the manuscript. Writing up: MS(% 35), ED(%35), AO (%20), SU (%10). All authors have read and approved the final manuscript. Submission and Revision: MS (%60), AO (%40)

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