Original Article

The Impact of Mandibular Advancement Surgery on Upper Lip Length in Class II Patients

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Abstract

Introduction: One of the most common maxillofacial malformations is mandibular advancement, a class II malformation or malocclusion. One treatment is mandibular advancement surgery. This research aimed to investigate the effect of mandibular advancement surgery on upper lip length in class II patients. **Methods:** This retrospective study was conducted with 16 patients having class II malformations who underwent mandibular advancement surgery. Data analysis was conducted using SPSS 19. **Results:** Results showed that although height of philtrum increased after surgery, there was no significant difference in the height of the philtrum from before to after the mandibular advancement surgery (p> 0.05). Evaluation of the patients showed that although commissure height and vermilion height decreased after surgery, this difference was not statistically different(P> 0.05). However, there was a statistically significant difference between before and after commissure height (P<0.05) at camouflage in patients. There was also a statistically significant difference in height of philtrum and vermilion between before and after camouflage in patients (P<0.05). **Conclusions:** The results of this study suggest that mandibular advancement surgery plays a serious role in the clinical appearance of lip soft tissue, which can be used as a predictor of patient profile prior to surgery.

Keywords: Lip vermilion, Upper lip, Philtrum, Mandibular

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Introduction

Every person has some degree of maxillofacial abnormality, such as tooth tilting, displacement, deflection, abnormal posterior or anterior position of mandible or maxilla, jaw-tooth disorders, or malocclusion (1). Malocclusion is, in fact, any misalignment in teeth arrangement that cause teeth to not naturally mate. Such abnormalities are due to interaction between genetic and environmental factors (2). The severity of these abnormalities can cause secondary oral problems and can lead to mental and social problems that are mainly caused by dental and facial aesthetic disorders (3). One of the most common disorders of maxillofacial is found in posterior mandible. This anomaly is known as class II malocclusion or disocclusion. In general, in this jaw-tooth disorder or malocclusion, mandible is shorter than maxilla and mandibular first molar is located distal to the maxillary first molar (4). Class II malocclusions are among most common ones and one of the most common maxillofacial malformations observed by orthodontists (5). The results of a study conducted to evaluate prevalence of malocclusion and hereditary

crowding among 7 to 9-years old children in a primary school in Shiraz, Iran, found that prevalence of class II malocclusions in boys was three times greater than girls (14.7%) (6). In a meta-analysis evaluating Iranian children aged 3 to 18 years, prevalence of class II malocclusions was estimated to be 24.7% (7). There are various approaches to address this disorder. One is to use a functional device that stimulates growth of this part of the face by inserting anterior mandible (8). Class II malocclusion accounts for approximately 70% of patients with skeletal abnormality. In patients with severe skeletal abnormalities, orthognathic surgery is indicated. The purpose of orthognathic surgery is to improve facial profile and fine tooth alignment, as well as improving function of the jaw (9). Prior to orthognathic surgery, final soft tissue profile and patient appearance should be evaluated by orthodontists and oral surgeons (10). To achieve an optimal postoperative profile, vertical ratios as well as soft tissue lines and relative posterior-anterior positions of the nose, lips, and chin should be investigated (11, 12). One element of facial soft tissue is upper lip length (13). Excessive gingival display (EGD), which is commonly described as 'gummy smile,' adversely affects smile aesthetics considered undesirable. EGD may be due to various factors such as skeletal problems of face and gums as well as facial muscle issues (14). There are many ways to address gingival display as well as gummy smile; these include orthognathic surgery for correction of maxillary deformity, myectomies to detach smile muscle attachment and prevent relapse, use of autogenous alloplasty isolates, and injection of type A botulinum toxin (15). The first studies on soft tissue surgery and mandibular reduction process were performed to quantify changes in lower lip and chin. These studies showed that a 1-mm mandibular movement backward caused a 0.6 mm to 0.75 mm soft tissue backward movement and 0.9 to 1 mm posterior movement of soft tissue of chin. Mandibular advancements have also been evaluated. Findings showed that where movement of soft and hard tissue of the chin is 1mm, changes in the lower lip varies between 0.38 to 1 up to 0.75 to 1mm (12). Soft tissue changes associated with maxillary surgery have also been evaluated , as many researches have offered that backward movement of the maxilla causes upper lip to move backwards (12). A study comparing soft tissue changes after mandibular advancement surgery demonstrated that soft tissue movement followed hard tissue movement (16). The optimal match of soft tissue and hard tissue has been debated in a study (17). Different researches have been conducted on soft tissue response to maxillary and mandibular surgery; however, it seems that investigation response of upper lip soft tissue to mandibular advancement surgery in class II malformations is not well unknown . So, the aim of this study was to evaluate effect of mandibular surgery on upper lip length in class II malformation patients.

Materials and Methods

This study is a retrospective study based on previous studies with an accuracy of 0.05 with a sample of 16 patients. People with class II malocclusion who underwent mandibular advancement surgery were identified for inclusion in the study.

In this study, the inclusion criteria were as follows:

1. One should only undergo mandibular surgery.
2. No aesthetic surgery was done on one's lips or nose.
3. The person had to be between 18 and 35 years old.
4. The height of one's face should not be short and the lips should not be turned.
5. After orthodontic treatment, no posterior and vertical incisor position changes were performed on the individual.

People who did not meet the inclusion criteria for the study were not enrolled in this study. After selecting the subjects, informed consent was obtained to participate. The space between internal contour of two eyes to the upper lip measured and recorded from a photograph at rest position. These ratios were compared at time of surgery and 6 months after surgery. The internal contour of both eyes to the upper lip length from a photograph at rest prior to surgery and six months after surgery was tested at significance level of $P<0.05$ using a paired sample t-test. Statistical analyses appropriate to variables of interest were used to assess study hypotheses.

Results

Results showed that although height of philtrum increased after surgery, there was no significant difference in height of philtrum before and after mandibular advancement surgery ($P> 0.05$). The increases in height were not sufficient to show a statistically significant difference compared to pre-surgical height. (Table I). Evaluation of patients showed that although commissure height and vermilion height decreased after surgery, there was no significant difference in commissure height or vermilion height after mandibular advancement surgery ($P> 0.05$). There was a

statistically significant difference between vermilion height and commissure height before and after at camouflage in patients(P<0.05) (Tables II) There was also a statistically significant difference in height of philtrum and vermilion after surgery in camouflage patients (P<0.05) (Tables III).

Table I: Difference in the height of the philtrum before and after mandibular advancement surgery

variable	Philtrum	
	Mean	SD
Pre-surgery	30.81	3.59
Post-surgery	31.28	3.92
P-value	0.58	

Table II: Difference between vermilon and commissure height before & after commissure height at camouflage in patients

variable	vermilon		Commissure height	
	Mean	SD	Mean	SD
Pre-surgery	9.09	1.68	33.67	4.18
Post-surgery	8.98	1.78	32.45	3.49
P-value	0.87		0.23	

Table III: Difference in the height of the philtrum and vermilionbetween before and after camouflage in patients

variable	Philtrum		vermilon	
	Mean	SD	Mean	SD
Pre-surgery	27.85	1.98	8.61	2.12
Post-surgery	29.80	3.86	9.34	2.52
P-value	0.02		0.03	

Discussion

Mandibular advancement surgery has been suggested as a routine treatment and correction for the treatment of maxillary malformations as well as for enhancement of aesthetical appearance. While much research has conducted to predict hard tissue behavior, soft tissue behavior has received less attention (18). As changes and modifications of deformations in hard tissue also cause changes and responses in soft tissue, importance of this

issue has become more apparent over time and has become a focus for researchers (19).

In a study by Uppada et al. (2014) in India, titles "Soft tissue alterations and its durability as a follower to mandibular advancement," soft tissues changes and stability was evaluated following skeletal movement. Surgical advancement of the mandible was performed through a bilateral sagittal split osteotomy to create patient with actual treatment for esthetic alteration expected. It was observed that angular measurements showed significant changes. Pursuant mandibular advancement surgery, profiles of patients were observed to improve with a decrease in facial convexity, an increase in lower facial height, decrease depth of the mentolabial sulcus. In addition, lip competency was improved with lengthening, straightening and thinning of lower lip, which is agreeable with results of present research (20). A study by Conley et al. (21) titled "Facial soft tissue alterations subsequent maxillomandibular advancement for remedy of obstructive sleep apnea," investigated horizontal and vertical facial soft tissue variations that arised after maxillomandibular advancement (MMA) surgery to treat obstructive sleep apnea (OSA). The findings demonsterated that maxillary movements middle 8.77 mm horizontally and 2.20 mm vertically. Mandibular movements averaged 11.16 mm horizontally and 2.25 mm vertically. The horizontal upper lip soft tissue-to-hard tissue ratios averaged >0.90:1; the upper lip length increased by a clinically inadequate quantity (0.37 mm) .In this research, upper lip length increased subsequent surgery, which is agree to Conley's findings. Veltkamp (11) performed a research to probe multi dimensional essence of soft tissue reply. Veltkamp apprehend that soft tissue answer to advancement surgery relation on pretreatment tissue thickness, horizontal skeletal movement, vertical skeletal movement and location of maxillary incisors (11).

In a study by Shelley et al.(22) in United States, evaluated profile aesthetic change following mandibular advancement surgery to define guidelines to clinicians to predict profile esthetic change. Also, to evaluate changes in aesthetic profiles as a result of the orthodontics combined with mandibular advancement surgery without genioplasty. On average, after mandibular advancement surgery, the B point moved 5.0 mm forward and 4.7 mm downward, and the ANB angle decreased by 3.0° , which was consistent with results of this study. A study by Sukil et al.(23) evaluate relative soft and hard tissue changes after mandibular advancement surgery demonstrated that ratio of changes in soft botanical of chin and lower lip compared to changes in mandibular hard tissue was 1: 1. The upper lip showed a low correlation with changes from this surgery (23), which contradicts results of the present study.

Conclusions: The results of this research suggest that mandibular advancement surgery plays an important role in clinical appearance of upper lip soft tissue, which can be used as a predictor of patient profile prior to surgery.

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Conflict of interest

The authors declare that they have no conflict of interest.

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