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Inferior scleral show changes following le fort I osteotomy in CL III patients with maxillary retrusion

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ABSTRACT

Introduction: In a balanced and symmetric face no sclera should be exposed below the irises. This study evaluated the inferior sclera exposure changes after maxillary advancement in skeletal cl III patients.

Materials and Methods: Eight consecutive patients (4 male and 4 female) with maxillary deficiency who underwent Le Fort I osteotomy were assessed using adobe photoshop CS5. Inferior sclera height to total eye height proportion was determined in both eyes in each patient and the propotional changes before and six month after surgery was statistically analyzed using Wilcoxon signed–rank test.

Results: Average maxillary advancement was 3.75 mm at the incisors. Proportion of inferior sclera to total eye height decreased by a ratio of 8% ($p<0.001$) in total 16 eyes of 8 patients. All 8 patients achieved a decrease of their scleral show. None of the patients required further cosmetic procedures in preorbital region.

Conclusion: Maxillary advancement in CI III patients with existing excessive scleral exporsure changes the lower lid position and leads to significant decreased scleral show.

Key words: Sclera show, Le fort osteotomy, skeletal cl III, Orthognathic Surgery.

Introduction

One of the most important esthetic units of face is periorbital unit. This unit consists of the eyes, eyelashes, eyelids and eyebrows. During on evaluation of facial esthetics each of this subunits should be considered. The visible part of the eye is made up of three vital structures: the colored iris, the black pupil and the white sclera. the white color of the sclera comes from a dense fibrous tissue that forms the outer covering of the eyeball [1]. Scleral show is an anatomical condition in which the sclera area is visibly exaggerated due to constitutional, evolutive, or endocrine etiology. It can also occurs because of iatrogenic conditions and is considered one of the most complex blepharoplasty complications [2]. Excessive inferior eyelid scleral exposure is considered an unattractive facial feature [3]. For facial aesthetic reasons, no sclera should be exposed below the irises when the head of a patient is in a neutral head position and the eyelids are in relaxed position [4].

Scleral show is usually caused by an interaction of increased lower lid laxity and lack of lid support caused by an interaction of increased lower lid laxity and lack of lid support caused by under developed cheek and orbital bones. Among these factors. scleral show commonly accompanies midface deficiency, especially when the deformity extends to the inferior orbital rim [5]. The increase in the exposure of sclera below the iris is a clinical indication and a characteristic orbital feature of patients with midface hypoplasia or retrognathia [6].

Idiopathic anteroposterior maxillary deficiency is distinguished from other skeletal cl III deformities by both frontal and profile features. Frontally, the patient may exhibit some inferior scleral show, decreased bizygomatic width, flat to concave paranasal areas, narrow alar base width and decreased exposure of upper lip vermilion. These patients often need maxillary advancement by Le Fort I osteotomy to correct skeletal cl III malocclusion. The position of the moveable lower eyelids can change after maxillary surgical movements and lead to a change in inferior sclera exposure [7].

Orthognathic surgical procedures can affect the amount of visible sclera although this has not been analyzed comprehensively. the aim of this study was to evaluate the change in inferior sclera exposure after maxillary advancement by Le Fort I osteotomy in skeletal Cl III patients with maxillary deficiency.

Materials and Methods

In a prospective randomized clinical trial this study was performed in Bu Ali hospital (Tehran-Iran) in 2016. Eight consencutive patients with excessive sclera exposure and skeletal cl III deformity (4male, 4 female; mean age 21.7+_5yr) who were treated with Le Fort I osteotomy concomitant with bilateral sagittal split ramus osteotomy by the same surgical team were included in this study. The exclusion criteria were craniofacial syndrome, systemic disease such as hyperthyroidism, exophthalmos, history of facial trauma and previous periorbital surgeries such as blepharoplasty.

A standard Le Fort I osteotomy technique was used for each patient. The horizontal osteotomy was through the pyriform rim, 5 millimeters above the roots of the teeth and below the infraorbital foramen on each side of the maxilla. Once the maxilla was surgically repositioned anteriorly, osteotomy fixtion was performed with a titanium plate (L-Shaped) contoured at each pyriform rim and zygomatic buttress region. The surgical change at the level of the maxilla was documented based on review of the analytic model planning for each patient.

Each patient underwent “maxillary first “ analytic model surgery. Specific vector change data points were measured including horizontal advancement at the maxillary incisors. These data points reflect the surgical objectives for the maxilla. They were recorded on an data sheet and maintained in each patients documentation.

The planned horizontal advancement measurements serve as an indicator of the degree of maxillary deformity and the extent of maxillary horizontal advancement to be achieved during operation. Standardized preoperative and six month postoperative facial photographs were taken with an SLR digital camera (canon EOS 45OD) mounted with a wide angle lens. The camera was placed at a distance of one meter from the patient. It was held in an upright position and the level of the camera was adjusted so that the lens was focused on the patients eyes.

The patients were instructed to look straight ahead at the lens of camera to achieve a neutral head position. They were sitting and instructed to relax their forehead, nose, mouth, and eyebrows while the frontal photography were being taken. The submandibular line of the patients was kept parallel to the floor.

All photographs were evaluated using the following landmarks: upper eyelid margin (a point), inferior limbus (b point) and lower eyelid margin (c point). The distance between b to c point was named as X and the distance between a to c points was named as Y. The X and Y represented the inferior sclera height and total eye height respectively (Fig 1). The proportional relation between the inferior sclera height (X) and total eye height (Y) was determined in preoperative and postoperative photographs (Fig 1). The proportion were measured by the same clinician using Adobe Photoshop CS5.

Statistical Analysis

The proportional relations of the preoporative and postoperative facial photographs were measured twice, the average was recorded, and statistical analysis was performed. The pre-and postoperative proportions were compared statistically by the Wilcoxon signed-rank test (level of significance, $p<0.05$).

Results

Analytic model planning confirmed that the study patients maxillary surgical change averaged 3.75 mm of horizontal advancement at the incisors (ranged from 2 to 6 mm; table 1). All study patients (8 of 8) were found to have achieved an improved lower eyelid position as a result of maxillary advancement (Fig 2,3).

A comparison of preoperative and postoperative proportional relations between the inferior scleral exposure and the total eye height of the 8 patients is presented in table 1. The average preoperative scleral show of the right eye was 11.8% of total eye height (ranged from 5 to 16%) and 11.2 % in the left eye (ranged from 7 to 18%) .The average postoperative scleral exposure of the right eye was 3.2 % (ranged from 0 to 7 %) and 2 % in the left eye (ranged from 0 to 8%).

Average decrease in scleral show of 8.6 and 9.2% compared with total eye height were noted in the right and left eyes respectively. These results were calculated to be statistically significant (p= 0.005). All eight achieved a decreas of their total eye height. Three of eight patients achieved complete correction of inferior sclera exposure. As expected, the decrease in scleral exposure between the right and left eyes was not statistically significant ($p<0.05$). None of the patients including the 5 with incomplete resolution of scleral show , required or requested further esthetic improvements in the periorbital region.

Fig-1.

Fig-2.

Fig-3.

Discussion

Eyes are the “windows to the soul”; attractive eyes are one of the main features of and symmetric and balanced face [8]. The eye and pre orbital region are among the most prominent and important aesthetic features of the face. It is often said that individuals “ speak with their eyes” [9].

An evaluation of the orbital region should be included in the preoperative clinical examination of patients scheduled for orthognathic surgery. Facial analysis of the patients can be performed not only by clinical examination, but also by facial photography [10]. Standardized facial photographs were used for the assessment in the present study.

Lower lid movement and position particularly is affected by the underlying bony orbit and facial skeleton [11,12]. Traditional concepts of periorbital rejuvenation focus on the soft tissue. Recently, supportive facial skeleton effects on periorbital esthetic have been investigated. Findings in these studies revealed retrusion of the midface skeleton and support the concept of midfacial skeleton augmentation as part of the algorithm for periorbital and midface rejuvenation and enhancement [13]. In absence of skeletal deficiency free fat grafting is an effective way for augmenting facial contour. This technique is intuitive for the restoration of soft tissue volume loss and can improve sclera exposure effectively [14].

Infraorbital implants are another usefull option to augment lower lid bony support and consequently a viable option to improve scleral show and have superiority over bone grafting, but in case of dental malocclusion, orthognathic surgery is the technique of choice [15].

Malar augmentation is a highly successful and predictable procedure. This procedure improves weak bony support of underlying structure and so enhances the projection of the malar prominence and subsequently improves sclera show [16,17]. In cases of skel-

etal cl III patients with maxillary retrusion, maxillary advancement by Le Fort I osteotomy affects midface soft tissue profile and makes concave faces convex. Concave faces often are considered less attractive than convex faces [18]. Patients with midface concavity have an underlying deficiency in maxillary and zygomatic skeletal projection. This deficiency predisposes the patients to develop excessive sclera exposure [19]. If skeletal midface deficiency is accompanied by cl III malocclusion, Le Fort osteotomy is required to normalize occlusion and to improve globe-rim relation and this improvement may decrease sclera exposure [20]. Le Fort osteotomy can be implemented in low or high level in maxilla and also may be designed for maxillary advancement with and without vertical shortening. Le fort I osteotomy is the surgery of choice if midface deficiency is limited to maxilla and can be performed in low or high level. If midface deficiency is because of maxilla-malar complex retrusion, modified le fort III osteotomy is the sugery of choice to correct midfacial deficiency. Each of these variation may have different effects on lower lid position and sclera exposure.

Garaas and Turvey Eyes are the "windows to the soul"; attractive eyes are one of the main features of and esthetic and balanced face [8]. The eye and pre orbital region are among the most prominent and important aesthetic features of the face. It is often said that individuals " speak with their eyes" [9].

et al compared the changes in sclera exposure after a modified Le Fort III osteotomy (Kufner) versus Le Fort I osteotomy with maxillary bone grafting [5]. Scleral surface area (SSA) in each eye was determined by pixel count. The distance from the inferior eyelid margin to the center of pupil (mid- pupil eyelid distance, MED) was measured in each eye both pre-and postoperatively.Average SSA decrease in Le Fort I and Le Fort III groups was reported 3.79% and 8.59% respectively.

Average MED decrease in Le Fort I and Le Fort III group was reported 3.51% and 9.33% respectively. The authors concluded that modified Le Fort III osteotomy decreased scleral exposure more predictably, and to greater clinical importance than a Le Fort I osteotomy with maxillary bone grafting.

The study conducted by Soydan et al reviewed a series of patients with maxillary horizontal deficiency [4]. These patients underwent maxillary advancement with and without impaction through Le Fort I osteotomy. For their study patients, the midface advancement improved the position of lower eyelids. The proportion of inferior sclera exposure to overall eye height showed a statistical decrease in percentage.

Posnick JC et al reviewed 10 patients with a long face growth pattern and excessive scleral show [3]. Their question was that is there improvement after maxillary advancement through Le Fort I advancement and simultaneous vertical shortening? They concluded that inferior sclera height to overall eye height proportion was averagely decreased 8 and 6 percent in right and left eye respectively. These results were statistically significant.

According to present study we concluded that maxillary advancement by standard Le Fort I Osteotomy improved scleral exposure in patient with skeletal cl III malocclusion and preexisting excessive scleral show. In all 8 patients the scleral exposure was significantly decreased in both eyes in all patients and resolved completely in three patients. The present study suggests that in cl III patients with maxillary deficiency and unattractive scleral show, surgical correction of the midface deformity through maxillary advancement will create a more favorable relation among the orbits, ocular globes and lower eyelids and improved scleral show.

				Per operative		Postoperative		Improvement	
Patients	Avg (yr)	Gender	Advancement	R.eye (%)	l.eye (%)	R.eye (%)	l.eye (%)	R.eye (%)	l.eye (%)
1	22	M	3mm	12	10	5	4	7	6
2	24	F	3mm	16	9	6	0	10	9
3	19	F	6mm	8	9	0	0	8	9
4	18	M	4mm	15	18	4	4	11	14
5	20	F	2mm	5	7	0	0	5	7
6	25	M	4mm	15	14	7	8	8	6
7	24	M	3mm	13	10	4	0	9	10
8	22	F	5mm	11	13	0	0	11	13
Mean	21.7	M (4)|F (4)	3.75mm	11.8	11.2	3.2	2	8.6	9.2

Table 1. Scleral show valuse and changes after maxiliary advancement.

Abbreviation: F=female M=male L=left R=right.

Conflict of Interest

There is no conflict of interest to declare.

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