

Zmiany, które można zaobserwować w obrębie nosa po operacji ortognatycznej szczęki

Changes that may be seen in the nose after maxillary orthognathic surgery

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Streszczenie

U pacjentów z ciężkimi kostnymi wadami zgryzu można zastosować protokoły chirurgicznego leczenia ortognatycznego szczęki i żuchwy z połączonym planowaniem ortodontycznym i chirurgicznym. Osteotomie środkowej części twarzy i żuchwy są stosowane w celu skorygowania trójwymiarowej dysmorfologii zespołu szczękowo-żuchwowego, okluzji, estetyki twarzy i niedrożności dróg oddechowych. **Cel.** W tym przypadku celem jest uzyskanie wyważonego wyglądu twarzy zarówno w zakresie kostnym, jak i tkanek miękkich oraz skorygowanie wad estetycznych i funkcjonalnych pacjenta. **Materiał i metody.** Adaptacja i równowaga tkanek miękkich jest bardzo ważna dla wyników leczenia. Prognoza efektów planowanych przez nas ruchów chirurgicznych jest możliwa i odgrywa bardzo ważną rolę podczas planowania chirurgicznego. Przewidywane zmiany powinny zostać zidentyfikowane, a ich celowość

Abstract

In patients with severe skeletal malocclusion, orthognathic surgical treatment protocols for the maxilla and mandible can be applied with joint planning of orthodontics and surgery. Midface and mandibular osteotomies are used to correct three-dimensional dysmorphism of the maxillomandibular complex, occlusion, facial aesthetics and airway obstruction. **Aim.** In this application, it is aimed to achieve a balanced facial appearance in both skeletal and soft tissues and to correct the patient's aesthetic and functional complaints. **Material and methods.** The adaptation and balance of the soft tissues is very important for treatment results. It is possible to predict the effects of the surgical movements we plan and this is very important during surgical planning. Anticipated changes should be identified and their desirability assessed during each individual's planning. The nasal soft tissues are highly affected by maxillary

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oceniona podczas każdego indywidualnego planowania. Ruchy szczęki mają duży wpływ na tkanki miękkie nosa, ale zmiany widoczne w tkankach miękkich również różnią się w zależności od indywidualnych cech. Estetyka nosa i analiza funkcjonalna powinny stanowić część planowania chirurgicznego leczenia ortognatycznego. Pacjenci powinni zostać poinformowani o zmianach, które mogą wystąpić w wyglądzie nosa i ich pozytywnych lub negatywnych konsekwencjach, przed zabiegiem chirurgicznym. **Wyniki.** Umożliwienie wprowadzenia zmian estetycznych i funkcjonalnych, które mogą być korzystne dla pacjenta, jest bardzo istotne, równie ważne jest wcześniejsze określenie negatywnych skutków. **Wnioski.** W niniejszej pracy przedstawiono przegląd piśmiennictwa dotyczącego konieczności chirurgicznego leczenia ortognatycznego i zmian w obrębie nosa w wyniku osteotomii Le Fort I. (Albayrak E, Kaya EK. **Zmiany, które można zaobserwować w obrębie nosa po operacji ortognatycznej szczęki.** *Forum Ortod* 2023; 19 (4): 134-9).

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Słowa kluczowe: chirurgia ortognatyczna, nos, Le fort 1, tkanki miękkie

Introduction

In patients with severe skeletal malocclusion, orthognathic surgery for the maxilla and mandible can be performed with the planning of orthodontics and surgery. Both skeletal and soft tissue changes are achieved by changing the upper and lower jaw positions.

Aim

In the early periods of orthognathic surgery planning, functional problems with skeletal deformities were prioritized and soft tissue changes were kept in the background. With the increase in aesthetic expectations in the later periods, it is very important to know the soft tissue changes that patients will encounter postoperatively in terms of treatment planning (1). A complete analysis of the treated structures is very important to achieve a successful result in facial aesthetic and reconstructive surgery. Lateral cephalometric films, intraoral and extraoral photographs, digital or manual impression models are taken from the patient in order to know the changes that may be encountered in the soft tissue after maxillary surgery and to create predictions in surgical planning (2,3). With these materials, changes that may be reflected on the soft tissue as a result of the direction and amount of movement in the maxilla can be determined more easily.

movements, but the changes seen in the soft tissues also vary depending on individual characteristics. Nasal aesthetics and functional analysis should form part of orthognathic surgical treatment planning. Patients should be informed about the changes that may occur in their nasal appearance and their positive or negative consequences before surgery. **Results.** It is very important to allow aesthetic and functional changes that may benefit the patient, but it is very important to determine the negative effects beforehand. **Conclusions.** In this study, a literature review is presented regarding the necessity of orthognathic surgical treatment and the changes in the nose as a result of Le Fort I osteotomy. (Albayrak E, Kaya EK. **Changes that may be seen in the nose after maxillary orthognathic surgery.** *Orthod Forum* 2023; 19 (4): 134-9).

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Material and methods

Since changing the position of the maxilla causes changes in the appearance and function of the nose, the nose should be a part of orthognathic surgery planning (4).

The nose is one of the most important parts of facial aesthetics and expression, and minor asymmetries and irregularities primarily attract the attention. Therefore, it must be taken care of that in any surgical procedure that may affect the nasal structure. Le Fort I operations for the maxilla is one of these surgeries (5). Some of the changes that occur in the nose are aesthetically desired results. For example, in a patient whose interalar distance is less than normal, the interalar distance is increased as a result of an orthognathic surgery planned by bringing the maxilla forward. In addition to the positive effects obtained, a second operation may be required for some of the changes in the nose. Although mandibular orthognathic surgical procedures do not directly affect the nasal structure, the change in the position of the lower jaw can relatively change the appearance of the nose. On the contrary, as a result of the procedures performed on the nose, a relative change in the appearance of the chin can be achieved. Likewise, there is no absolute change in the size of the nose as a result of the genioplasty operation applied to the pogonion. However, it has been said that the prominence of the nose compared to the pogonion and forehead may relatively increase (6).

Results

Effects Of Orthognathic Surgery On Soft Tissue

Since the expected changes in soft tissues may also be different due to differences in individual characteristics, it is reported that it is not possible to predict the changes that may occur with certainty (7). Facial soft tissue thickness may differ between individuals. If the patient has thick soft tissue, it may not reflect skeletal changes much, because thick soft skin may support the hard tissue more (8). The soft tissue response in the parts where the muscle attachment is attached to skeletal structures may be higher than in other parts (9).

Muscle tones may also show individual differences, and it is said that in individuals who are tighter, movements are generally reflected more in the soft tissue (10). In addition, the amount of dissection performed on the soft tissue, the location of the osteotomy incisions, the size of the surgical movement and the fixation method can also change the response from the soft tissue, either positively or negatively (6).

It has been reported that the changes in soft tissue seen after surgery generally vary according to the inflammatory severity caused by surgical procedures.

Although the number of patients evaluated in a few studies examining preoperative and postoperative three-dimensional facial scans was limited, some important determinant results were obtained (11,12). It has been reported that soft tissue edema is usually seen at most 48 hours after surgery, but individual differences may be high. It has been stated that edema-induced asymmetry in the tissue is normally encountered in the postoperative period and the healing of this asymmetry may also be different. It was also said that the edema and healing process in the maxillary region was faster than in the mandibular region. This can be explained as the effect of gravity on tissue fluids. In general, it has been reported that approximately 60% of the edema regresses within 1 month postoperatively, and a period of at least 6 months is needed for complete resolution (6).

Le Fort I Osteotomy

In our day, the Le Fort 1 technique has become one of the techniques used safely and widely as a result of advances in surgery and anesthesia, developments in rigid fixation materials and positive studies on the blood supply of the maxilla. During osteotomy, a horizontal incision is made at the apical level of the maxillary tooth roots and at least 5 mm above the attached gum to reach the anterior, lateral and pterygomaxillary regions of the maxilla. The incision borders extend from the 1st molar tooth on the right side to the 1st molar tooth on the left side. With subperiosteal dissection, the edges of the apertura piriformis and the infraorbital nerve are first seen and the anterior zygoma, zygomatic buttress and zygomaticomaxillary suture are extended until they are seen (13). The pterygoid process is advanced and the nasal mucosa is separated from the

lateral nasal wall and floor. The osteotomy is started from the most convex surface of the zygomatic buttress, where the saw tip is most comfortably positioned, and is extended and completed to the lateral piriform edge. The nasal septum and vomer are separated from the maxilla with the osteotome. A small beveled osteotome is placed medially and inferiorly to the pterygomaxillary junction and the osteotomy is completed. In this way, the maxilla can be broken downward with a simple movement and can be completely free. If all osteotomies are completed properly and accurately, not much force should be required to free and break the maxilla. However, if the maxilla does not break down easily, each previous osteotomy should be carefully checked and repeated if necessary. The maxilla and mandible are fixed to each other in the appropriate occlusion with the occlusal splint made in accordance with the movements planned by the orthodontist. Depending on the planning, soft tissue tension may occur in this area in order to position the maxilla in the postoperative position without tension. In the appropriate position, four mini-plates are placed and fixed in the lateral nasal wall area with both zygomaticomaxillary buttresses (14).

It has been reported that the primary changes encountered in the soft tissue after Le Fort I osteotomy are in the nose (nasolabial angle, nasal tip, alar base), upper lip and paranasal region (6). It has been explained that the main reason for the enlargement of the alar base in patients after osteotomy is dissection in the soft tissue rather than skeletal movements (15). In addition, It has been reported that muscle attachments (zygomaticus major, levator labii superioris, levator labii superioris alaeque nasi and nasalis) may be disrupted because the periosteal flap was removed and enlargement in the alar region and thinning in the upper lip may occur due to muscle traction force (5).

Changes That May Be Observed In Nasal Morphology After Orthognathic Surgery

When examining the nasal symmetry and morphology, it is first evaluated whether the alar base width is equal to the intercanthal distance. Ideally, the distance between the nasal tip and subnasale should be twice the distance between the two nasal wings (16). The distance from the glabella point to the subnasal point should be one-third of the vertical height of the face (17). The nasal septum, the places where the lower medial and lateral cartilage connect with the septum, support the nasal tip. Since these structures are directly related to the maxilla through the anterior nasal spin and nasal crests, they are affected by maxillary movements (17).

It has been reported that the width of the alar base increases with maxillary advancement, the nasal tip is raised and widened, a slight depression is seen at the upper part of the nasal tip, and the columella slightly hangs down and shorten (18). If the nasal tip is desired to be raised more, the lower medial cartilage can be repositioned. It has been

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stated that if there is a dorsal hump in the nose before the surgical operation, this appearance can be improved by lifting the tip of the nose (6). Increasing the width of the alar base also causes an increase in the nasolabial angle (19). In a study performed by taking a three-dimensional facial scan, it was reported that as a result of bringing the maxilla forward, the subnasale hard tissue movement was around 80%, while the stomion superius was 70% and the commissure corners were 45% (20).

In his study, Freihofer reported that the subnasal followed the forward movement of the maxilla by 60% and the nasal tip by 33% (21). Soncul and Bamber reported that they observed movements of 81% and 29%, respectively (22). Differences in the amount of intraoperative surgery may be considered as the reason why these rates are not the same.

It is observed that the soft tissues in the middle region of the face follow the maxillary movement at a higher rate than the soft tissues on the outer side. The reason for this has been explained as the fact that the maxilla is semicircular and the muscle attachments are more tightly connected to the bone in the middle region of the face (22). In skeletal Class III cases, part of the deformity is due to maxillary hypoplasia and poor support to the alar bases and the interalar distance is narrowed in these patients. Given this, a slight increase in the width of the alar base is well received by patients. It is reported that there is always an increase in the width of the nasal base and nasal wings as a result of maxillary advancement (23,24,25). Chung et al. reported an increase in this situation even in patients who underwent cinch suturing if the maxilla was brought forward (26).

It has been reported that effects such as widening of the alar base, elevation and widening of the nasal tip have been observed with maxillary recessing motion, similar to the advancement movement (6). During maxillary impaction, it is important to properly cut the septum cartilage. Because lateral deviations may be observed that may obstruct the nasal airway or cause asymmetrical shifting of the nose.

It has been reported to be careful about the fact that drooping of the maxilla may cause the alar base, columella and nasal tip to fall downward to some extent, which may result in a "parrot's beak" deformity (15).

As a result of retraction of the maxilla, it was observed that the nasal tip fell. In addition, it has been reported that the nasolabial angle increases with decreased upper lip support as a result of this surgery and enlargement of the alar base may be seen with soft tissue dissection (6).

Changes That May Be Obtained In Nose Functions After Orthognathic Surgery

Maxillary osteotomies change the nasal airway resistance by changing the volume and anatomy of the nose. A decrease in nasal airway resistance has been observed after maxillary inserting, maxillary advancement and maxillary expansion surgeries (27,28). The reason for this can be said to be

the opening of the inner walls of the nose as a result of the enlargement of the nostrils.

Intraoperative Procedures To Control Nasal Changes During Orthognathic Surgery

A. V-Y Suture Technique

It involves advancing the vestibular incision medially, helping to approximate the nasolabial musculature to prevent the shortening and thinning tendency that may be seen in the upper lip after Le Fort 1 osteotomy (29). Studies in the literature have reported that shortening of the upper lip can be minimized with the V-Y suture technique (30,31). However, there is also a study explaining that no statistically significant difference was observed (32). In addition, in a study comparing the cinch suture and V-Y closure technique with the group using only cinch suture, a statistically significant difference in upper lip height ($1.10 \text{ mm} \pm 0.34$) was observed when the two techniques were used together, indicating a 23% increase from the shortening in the group using only cinch suture ($-0.79 \text{ mm} \pm 0.45$) (33). In the V-Y suture technique, while closing the maxillary vestibular incision, the middle region of the incision is pulled anteriorly and the line formed is sutured anteroposteriorly. Although it causes a full and short appearance in the midline of the lip at first, the lip length takes its normal appearance afterwards. It has been reported that if the V-Y suture technique is not used, the thinning of the upper lip that occurs during the anteriorization of the maxilla and the decrease in vermilion visibility seen as a result of maxillary embedding are inevitable (34).

B. Alar Base Cinc Suture Technique

It is a technique defined to minimize alar base enlargement with maxillary surgery in patients with normal or wide alar bases (35). First, the cinch suture technique was started to be applied by Millard for patients with cleft lip and palate (36). Later, many modifications were described (35,36,37).

The reasons for increased nasal width after maxillary osteotomies include elevation of the perinasal and perioral muscles without approximation, periosteum and muscle attachments adjacent to the nose, displacement of the supporting bone towards the base of the nose and edema (29,37). For the original cinch suture, 3/0 non-resorbable suture is used. The suture is passed through fibrous soft tissue and one side of the alar base, pulled to the desired width, tied and fixed under the transverse nasal muscle (38). The controlled placement of the perinasal muscles is thought to provide a more stable result than random repositioning (39). The appropriate nasal width and form may not be given during surgery. Because it is expected to open a little bit afterwards, it can be sutured to be narrower than the normal nasal width. Despite the excessive tension encountered, the cinch suture is very unlikely to change the anatomical structure of the nose to be narrower than the original alar base

width (40). It has been shown that upper lip shortening is prevented when V-Y suture and alar cinch suture are used together after maxillary embedding surgery (41). It has also been reported to preserve vermilion visibility, support the maintenance of anteroposterior lip thickness, and prevent the corner of the mouth from sagging down (29,41). In cases where the anterior nasal spina can be preserved as much as possible during surgery and dissection can be reduced, cinch suture may not be necessary (42). However, the effect of cinch suture in preventing alar floor widening is still controversial. A prospective study reported a very small clinical reduction in alar floor width (0.5 mm) (43). Another retrospective study reported a statistically significant reduction in alar floor width (1.6 mm) with cinch suture (37).

C. Anterior Nasal Spine (ANS) Recontouring

In some cases, if the nasal tip lifts upward with the advancement of the maxilla, the ANS can be reduced while advancing the maxilla to control the rotation of the nasal tip. However, it is often not easy to determine the amount and location of bone to be removed, and measurement on cephalometric radiographs is difficult due to differences in the anatomy of the region. In one study, it was reported that the ANS has a significant effect on nasal tip protrusion and that nasal tip movement may be more if the filing is skipped (44,45). Likewise, in another study, it was reported that recontouring of the ANS caused the ratio of the change in point A of the nasal tip to decrease from 33% to 25% (46). Unlike these studies, Gassmann et al. reported that whether the ANS was filed or not was not associated with nasal tip protrusion (47). However, the number of clinically proven studies is very small and the change in the nasal tip may not be exactly similar due to differences in the amount of surgery performed.

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Conclusions

Nasal aesthetics and functional analysis should form part of orthognathic surgical treatment planning. Patients should be informed about the changes that may occur in their nasal appearance and their positive or negative consequences before surgery. It is very important to allow aesthetic and functional changes that may benefit the patient, but it is very important to determine the negative effects beforehand. In severe cases, secondary procedures such as septorhinoplasty may be required.

Although simultaneous rhinoplasty with orthognathic surgery may seem attractive for the patient, it is not recommended very often because a mistake in planning may not result in a high quality result. As a result of the movements applied to the maxilla, the shape of the nose will change and will not be the same as the preoperative observations. This will complicate the procedures during rhinoplasty, no matter how well planned. Additionally, two separate surgeries can take several hours, making the operation quite long. Another negative factor is that nasal intubation is preferred during orthognathic surgery, while oral intubation is used during rhinoplasty. It should not be overlooked that moving intraoperative intubation from the nasal to the oral region may increase the risk of extra problems in anesthesia.

Declarations

Ethical approval

This study did not require the approval of the ethics committee, since it contains only public data.

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Availability of data and materials

Since this article is in the review category, it does not contain any material.

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