Original Article / Çalışma - Araştırma

Analyses and classification of complexities in rhinoplasties based on factors increasing the difficulty and their appropriate reconstruction

Rinoplastilerin kompleksitelerinin, zorluğu artıran faktörlere göre analizi, sınıflandırılması ve uygun onarımları

Aret Çerçi Özkan, MD.,[1] Ahmet Mert Bilgili, MD.,[1] Erdem Güven, MD.[2]

[1]*Private Practice, İstanbul, Turkey*

[2]*Department of Plastic and Reconstructive Surgery, İstanbul University, İstanbul Medical Faculty, İstanbul, Turkey*

ABSTRACT

Objectives: This study aims to classify the factors that make rhinoplasty difficult and appropriate reconstruction of it.

Patients and Methods: We retrospectively evaluated the records of 103 patients who underwent rhinoplasty at our private clinic between April 2002 and December 2014. The most important reagent affecting the degree of difficulty in our study was the adhesion of the bone and cartilaginous structures to the skin and mucosa, as an outcome of on previous operations. Structural deficiencies in various parts of bone and cartilaginous structures, presence of septum deviation at a very advanced level, asymmetries in the lower and upper lateral cartilages, fracture deformities or trauma-related bone compressions, skin quality and thickness and the age of the patient were other criteria that affected the degree of difficulty of rhinoplasty. Taking these compelling factors into consideration, a difficulty coefficient table was set up with a new classification that determines complexity and suggests appropriate reconstructions.

Results: The total of difficulty coefficients of rhinoplasties between 1-3 were considered to be less complex, those between 4-6 as intermediate complex and those being >7 as very complex rhinoplasty.

Conclusion: Calculation of the difficulty coefficient provides objective determination of the degree of difficulty of the operation. Reconstruction plans, probable duration of surgery, preoperative preparations, all grafts and materials considered for use may be predicted according to the difficulty coefficient. The surgeon can test whether his or her experience is sufficient or not according to the difficulty coefficient. Surgical risks can be assessed in the light of the difficulty coefficient and shared with the patient.

Keywords: Cartilage grafts; classification; complex rhinoplasty; secondary rhinoplasty.

ÖZ

Amaç: Bu çalışmada rinoplastiyi zorlaştıran faktörlerin ve uygun onarımlarının sınıflandırılması amaçlandı.

Hastalar ve Yöntemler: Nisan 2002 - Aralık 2014 tarihleri arasında özel kliniğimizde rinoplasti ameliyatı olan 103 hastanın verileri retrospektif olarak değerlendirildi. Çalışmamızda zorluk derecesini etkileyen en önemli ayıraç daha önce geçirilmiş ameliyatlara bağlı olarak burundaki kemik ve kıkırdak yapıların deriye ve mukozaya yapışıklığıydı. Kemik ve kıkırdak yapıların çeşitli kısımlarında yapısal eksikliklerin bulunması çok ileri derecede septum deviyasyonu varlığı, alt ve üst yan kıkırdaklardaki asimetriler, kırık deformiteleri veya geçirilmiş travmaya bağlı kemik kompresyonları, derinin kalitesi, kalınlığı ve hastanın yaşı da rinoplastinin zorluk derecesini etkileyen diğer kriterler idi. Karşılaşılan bu zorlayıcı faktörler göz önünde bulundurularak kompleksiteyi belirleyen ve bunların uygun onarımlarını öneren yeni bir sınıflandırma ile zorluk katsayısı tablosu oluşturuldu.

Bulgular: Zorluk katsayıları toplamı 1-3 arasında olan rinoplastiler az kompleks, 4-6 arasında olanlar orta kompleks, >7 olanlar ise çok kompleks rinoplastiler olarak kabul edildi.

Sonuç: Zorluk katsayısının hesaplanması ameliyatın zorluk derecesinin objektif biçimde tespitini sağlar. Onarım planları, olası ameliyat süresi, ameliyat öncesi hazırlıklar, kullanılması düşünülen tüm greft ve malzemeler zorluk katsayısına göre ön görülebilir. Cerrah kendi deneyiminin yeterli olup olmayacağını zorluk katsayısına göre test edebilir. Cerrahi riskler zorluk katsayısı ışığında değerlendirilip hasta ile paylaşılabilir.

Anahtar Sözcükler: Kıkırdak grefti; sınıflandırma; kompleks rinoplasti; sekonder rinoplasti.

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Correspondence / İletişim adresi: Aret Çerçi Özkan, MD. İncirli Cad., Bayrak Apt., No: 89/7, 34147 Bakırköy, İstanbul, Turkey.

Tel: +90 532 - 476 35 02 e-mail *(e-posta):* aretmd@hotmail.com

Classifying the rhinoplasty operation as simple or complex is a matter of relativity because even the most simple appearing rhinoplasty can be a technically demanding procedure. The surgical difficulty of secondary rhinoplasty is approximately twice that of primary rhinoplasty because of the high rate of major deformities.[1] Rhinoplasties classified as simple are usually reduction rhinoplasties. Rhinoplasties classified as complex are usually augmentation rhinoplasties. Albeit operating on same tissues, reduction and augmentation techniques show some differences. However this does not mean that reduction is simple because challenging factors making the rhinoplasty complex (e.g. high deviated septum, asymmetric lower lateral cartilages, nasal skin that has lost some degree of its elasticity etc.) are very possibly faced in a simple appearing rhinoplasty. A new description of classification and rating for complexities faced in rhinoplasties can be more precisely prepared if the challenging factors and application of different techniques among them is underlined in detail.

PATIENTS AND METHODS

We retrospectively selected 103 complex cases (42 males, 61 females; mean age 32 years; range 18 to 70 years) from our total rhinoplasty series operated between April 2002 and December 2014. Our complexity criteria during this selection were presence of severe traumatic deformity (n=49), presence of lip nose deformity (n=3), old age (>60 years) (n=6), iatrogenic deformities (n=43), post infectious deformities (n=2). In all of these selected cases we applied an open rhinoplasty with columellar incision and submucous dissection.

Correction of conchal hypertrophy by radiofrequency and meticulous correction of septal deviation was considered in all cases if needed. In secondary cases minor irregularities of the nasal dorsum were smoothed with a rasp. Lateral osteotomy was performed in all primary cases and in nearly all secondary cases. Spreader and strut grafts were almost always inserted routinely whether it was a primary or a secondary case.

The reconstructive plan of full-thickness nasal defects included recreation of internal nasal lining, skeletal and cartilaginous support and external cover.[2] Dissection time of nasal skin and inlaying mucosa in iatrogenic deformities and postinfectious deformities was at least two times longer and considerably more difficult compared to dissection time in primary cases. Complications of skin and soft tissues could be atrophy, fibrosis, numbness, cysts, scars, telangiectasia originating from displaced mucosa or subcutaneous granulomas caused by ointment material.[3]

Osteocartilaginous defects were repaired preferentially by neighboring cartilaginous grafts if available or distal cartilaginous grafts if further grafts were needed, with the belief that cartilaginous grafts should be considered if the dimensional changes have priority in the preoperative plan.[4] In places where durability and resistance was essential such as nasal dorsum and septum, costal cartilage was preferred. In places where softer support and pliability were necessary, auricular cartilage was preferred. However rolling the auricular cartilage in a shape of a cylinder or a pipe by suturing the approximating edges dramatically increased the durability and resistance of auricular cartilage thus we used this pipe shaped auricular cartilage as a strut graft, septal extension graft etc. in selected cases.

In iatrogenic deformities where the skin was very thin either due to its nature or to previous wrong plane dissection, we judged whether to operate or not very cautiously. This was because such overlying skin can be very unhealthy and prone to tears, and/or circulatory insufficiency during or after the operation. In these cases we preferred not to operate as we did in five cases since the beginning of our series. If the quality of skin was relatively good and suitable for reoperation we still preferred to use deep temporal fascia graft just underneath the skin both to augment the quality and thickness of the skin and to cover and camouflage the cartilaginous construction onlay as a blanket.

The effects of age on the skin, ligaments, and cartilage of the nose conspire with the relentless pull of gravity to create a ptotic tip and collapsing nasal sidewalls.[5] Aging patients present unique technical challenges in rhinoplasty that warrant a comprehensive approach to restore internal and external valve competency and tip support.[6]

Aging may cause a weakening of the tip-supporting mechanisms and de-rotation of the nasal tip.[7] Management of rhinoplasty in elderly patients generally did not differ from normal primary rhinoplasties except special care for above mentioned changes. Gentle touch and extra care was necessary to overcome brittleness of osteocartilaginous structures. Additionally we used ultrathin crushed wide septal cartilage graft laid just underneath the nasal skin as if a subdermal cartilaginous skeletal construction to avoid skin drooping and redundancy (Figure 1).

In patients with sun damaged or thin skin, meticulous care was given for smoothness of the nasal dorsum. Thin crushed cartilaginous graft was inserted beneath the skin over the dorsum for camouflage if needed. In thick and sebaceous nose, very conservative and cautious thinning of subdermal tissue was considered.

RESULTS

After facing all the above-mentioned difficulties several times in 12 years we tried to compile a table of factors affecting complexity. First we decided to divide the complexities into two major groups based on the difficulty of soft tissue dissection: the "cohesiveness group" and "non-cohesiveness group". We then added the other factors as subgroups in the order of decreasing degree of complexity. Finally we gave a "difficulty coefficient" for each factor.

This detailed classification covers most if not all factors that make the rhinoplasty difficult in decreasing order. Evaluation of a case through such classification can be more accurate than subjectively classifying the rhinoplasty as simple or complex. This is because some factors causing complexity may be present and may even be hidden in a simple appearing rhinoplasty. Rating those factors of complexity provides better clarification and more objective numerical estimation of difficulty of each specific case. By simply adding the related coefficients of each factor for a specific case we can easily reach a sum value that will estimate the possible degree of difficulty of that rhinoplasty (Table 1).

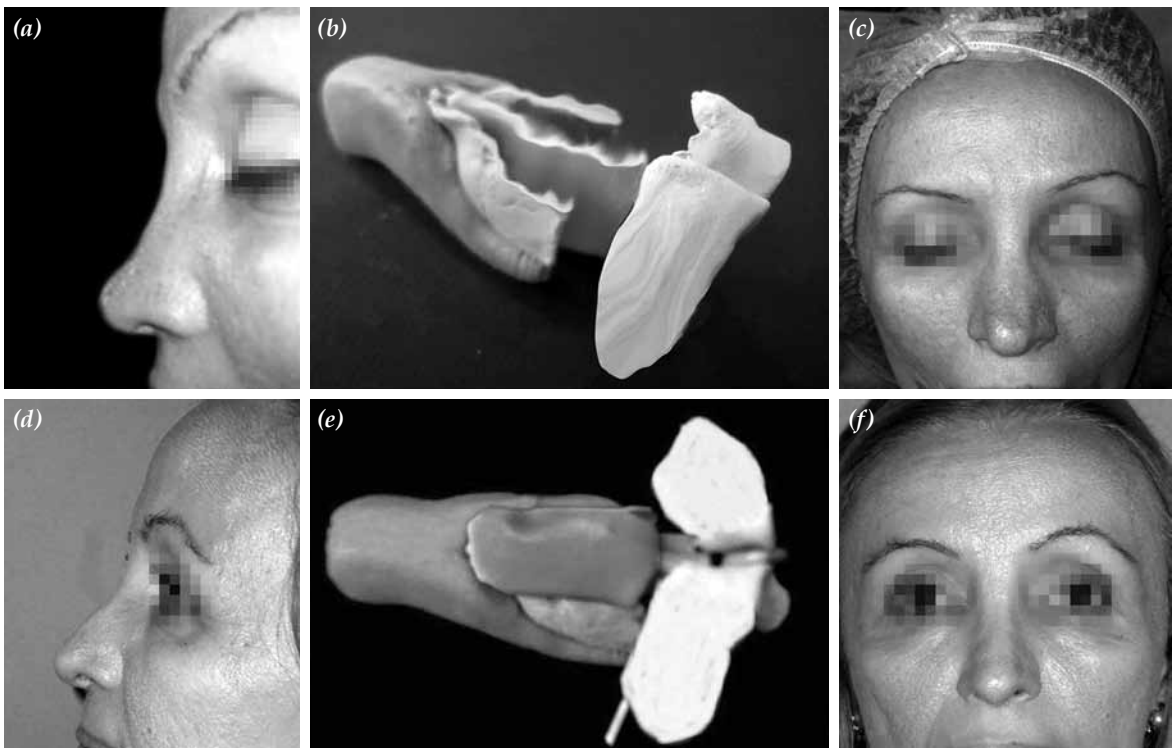

Figure 1. ***(a)*** *Preoperative anterior view.* ***(b)*** *Polymeric clay cast of present deformities.* ***(c)*** *Postoperative lateral view: ('Saddle' nasal dorsum, irregularities over the bone and cartilages, telangiectasia over nasal skin).* ***(d)*** *Postoperative anterior view.* ***(e)*** *Polymeric clay cast of reconstruction.* ***(f)*** *Postoperative lateral view: (Spreader grafts harvested through septum, Camouflage graft added by auricular conchal cartilage, deep temporal fascia graft laid under nasal skin).*

Table 1. Main factors complicating the rhinoplasty in the order of decreasing difficulty coefficients

Complicating factors in rhinoplasty	Difficulty coefficient
"Cohesiveness during dissection" group	
Iatrogenic deformities	
With soft tissue deficiency and osteocartilaginous defect	9
With soft tissue deficiency and osteocartilaginous excess	8
With anteriorly located septal perforations	7
Without soft tissue deficiency but with osteocartilaginous defect	6
Without soft tissue deficiency but with osteocartilaginous excess	5
Post-infectious deformities with cartilaginous loss	5
"No cohesiveness during dissection" group	
Advanced osteocartilaginous deformities due to considerable trauma	4
Lip-nose deformity	4
Asymmetric and or deformed lower lateral cartilages	3
Primary rhinoplasties of elderly patients	3
Previous lacerations of nasal skin	2
Sun damaged of very thin skinned patients	1
Sebaceous thick skinned patients	1

DISCUSSION

In rhinoplasties, several factors increase the difficulty of procedure. These factors can be used for classification of complexities faced in rhinoplasties. It is wise to remember that though not all of these factors are faced in very simple appearing rhinoplasties, some may be. Additionally, osteocartilaginous integrity of the nose in a primary case may hide these above-mentioned factors and these can be revealed after dissection during reshaping of the nose. That is why simple rhinoplasty is not simple.

The most crucial indicator in discriminating their degree of difficulty is the amount of cohesiveness or stickiness of nasal osteocartilaginous structures to overlying skin and inlying mucosa. Cohesiveness always increases the technical difficulty of the operation not only due to troublesome dissection but also due to the common coexistence of osteocartilaginous defects. Even a simple previous septoplasty may increase the stickiness of mucosa and reduce the availability of cartilaginous graft reserve. In some cases extreme degrees of cohesion of soft tissues that usually resulted from wrongly planned dissections in previous operations may even hinder access for possible correction and preclude further operation. Thus we decided to tag these kinds of complexity factors with high "difficulty coefficient" numbers.

The presence of structural defects in several parts of the nasal osteocartilaginous vault is the second most important cause increasing the difficulty of procedures arising as a necessity for delivery of autogenous cartilage grafts from neighboring regions such as septum or upper/lower lateral cartilages and/or distant regions such as ear and rib, or use of an cartilage allograft (Figure 2). Delivery of autogenous cartilage grafts from distant region also can be regarded as a reason of additional difficulty. Delivering an autogenous cartilage graft from septal and/or lower lateral cartilages can be compared with delivering an autogenous cartilage graft from ear or rib with respect to difficulty of harvest. Nasal osteocartilaginous defects are almost always associated with cohesion of above-mentioned soft tissues, which increases the degree of difficulty of operation. Some of the iatrogenic deformities present with osseous and/or cartilaginous excess. In these cases, soft tissue dissection is also more difficult than a primary case but generally easier than cases presenting with osseocartilaginous defects because the presence of cartilage can guide the surgeon for appropriate dissection.

Fascia grafts are useful in the camouflage of various nasal deformities in the dorsum and

sidewalls.[8] In iatrogenic deformities where the skin is very thin either due to its nature or due to previous wrong plane dissection we preferred to use deep temporal fascia graft to cover the cartilaginous reconstruction onlay as a blanket not only to camouflage the minor irregularities but also to support overlying skin quality. It was one of our clinical observations to see the healing of telangiectasia caused by wrong plane dissection after inserting a deep temporal fascial graft underneath the thinned skin. Healing of telangiectasia is most probably related to relieving of repetitive minor trauma to overlying skin caused by minor osteocartilaginous spurs (Figure 3).

In very selected cases, septal perichondrium that has already dissected from septal cartilage can be harvested as perichondrial graft by meticulous dissection off the mucosa. This pericohondrial graft can be used as a camouflage graft between soft tissue and cartilage for minor corrections.

The presence of septal perforation is the third important issue in nasal repair, not just because its healing is difficult but because it further complicates dissection of inlying mucosa. Perforation repair represents a challenge to most surgeons owing to the low rates of successful correction with some techniques.[9] If it is located deep, does not have any relation with our dissection plane, and does not bother the patient we usually prefer to leave it untouched and unrepaired. Nevertheless if it is located anteriorly, especially in the region where we will insert a cartilage graft for structural support or if it bothers the patient we try to seal them with mucosal rotation flaps.

The presence of severe deviation and/or deformation of the septum is another important factor enhancing the difficulty of the procedure. These kinds of deviations are caused either by acute trauma (such as traffic accidents, heavy smashes to the ground or wall, fights etc.) or by repetitive traumas usually faced in patients

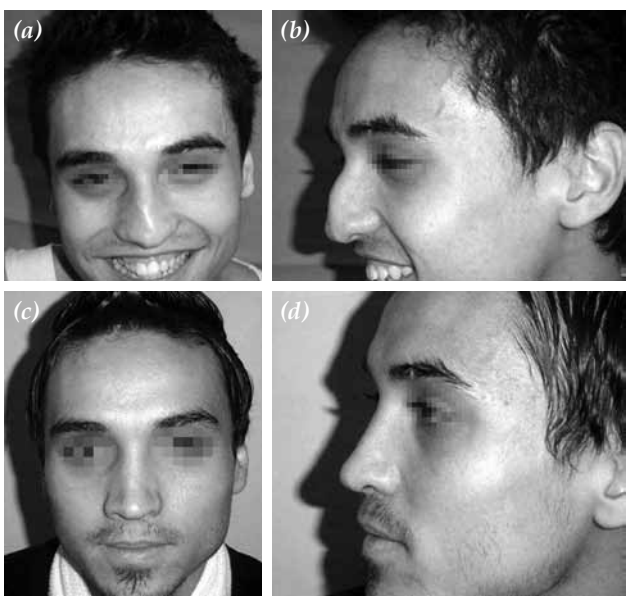

Figure 2. ***(a)*** *Preoperative anterior view.* ***(b)*** *Preoperative lateral view: (Traumatic advanced septal deviation, prominent hump, bifid and hanging tip).* ***(c)*** *Postoperative anterior view.* ***(d)*** *Postoperative lateral view: (Total correction of deformities with primary open septorhinoplasty).*

Figure 3. ***(a)*** *Preoperative anterior view.* ***(b)*** *Preoperative lateral view: (Prominent hump, hanging and bulbous tip, aging changes of nasal skin).* ***(c)*** *Postoperative anterior view.* ***(d)*** *Postoperative lateral view: (Redrape of skin is accomplished by means of wide ultrathin crushed cartilage under the skin at tip region).*

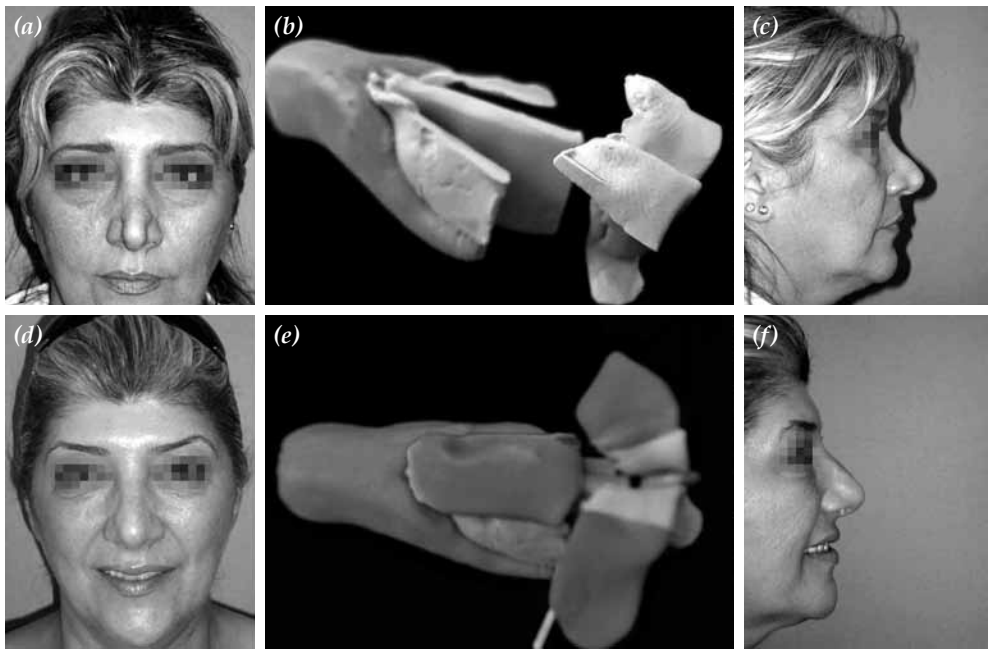

Figure 4. ***(a)*** *Preoperative anterior view.* ***(b)*** *Polymeric clay cast of present deformities.* ***(c)*** *Postoperative lateral view: (Inverted 'v' deformity, prominent pinch deformity.* ***(d)*** *Postoperative anterior view).* ***(e)*** *Polymeric clay cast of reconstruction.* ***(f)*** *Postoperative lateral view: (Spreader grafts derived from septum, lower lateral cartilages are restored with auricular conchal cartilage, camouflage graft added by auricular conchal cartilage, deep temporal fascia graft laid under nasal skin).*

formerly interested in fight sports or team sports (Figure 4). For proper repair of such septal deviations our ultimate goal is to create a straight, stable, durable, L-shaped septum and open nasal valves. Restoration of high deviations or septal bends that persist in any part of prepared L-shaped septal cartilage is still technically demanding. In such cases it is important to remember that perfection may not be possible to achieve.[10] In high deviations, asymmetric spreader grafts can solve the problem. In septal bendings, total or near total thickness cut of septal folds through its concave side and laterally reinforcing it by a piece of septal cartilaginous graft support may help to correct the issue. In more severe septal deviations involving both dorsal and caudal portions of the L-strut where correction of cartilage is not possible in the nasal cavity, extracorporeal preparation of straight L-shaped septum is considered.[11] Spreader grafts are almost always sutured to both sides of this extracorporeally prepared septal cartilage before reinsertion.

Asymmetries in lower and upper lateral cartilages, fracture deformities or compression of bone due to previous severe trauma have several degrees of effects on difficulty of rhinoplasties even in primary cases without any soft tissue cohesion (Figure 5).

The quality and thickness of skin can also affect the degree of difficulty and finesse of postoperative result. Sebaceous thick skin, sun damaged skin, or skin with previous lacerations may complicate the result.

In elderly patients the osteocartilaginous structures become more brittle and nasal skin re-draping becomes considerably insufficient causing some degree of drooping and redundancy of the skin and/or wrinkling. Management of rhinoplasty in elderly patients generally does not differ from normal primary rhinoplasties. However, very gentle touch and extra care is necessary to overcome the brittleness. Ultrathin crushed wide septal cartilage graft can be laid underneath the nasal skin as a subdermal cartilaginous skeletal construction to avoid skin drooping and redundancy. These can also be considered as negative factors adding some complexity on the operation.

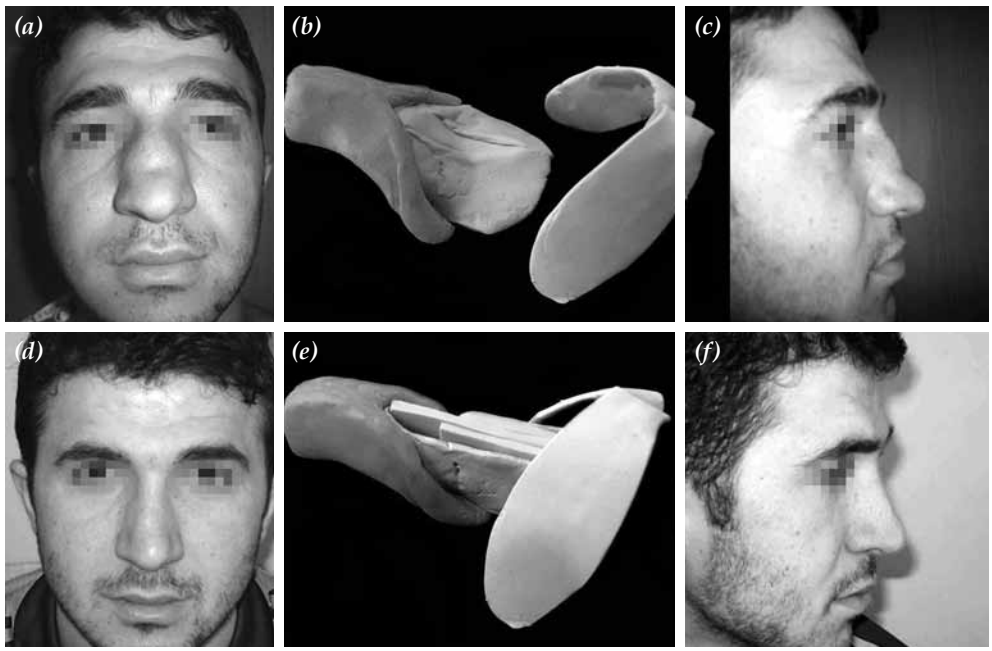

Figure 5. ***(a)*** *Preoperative anterior view.* ***(b)*** *Polymeric clay cast of present deformities.* ***(c)*** *Postoperative lateral view: (Traumatic compression fracture of nasal dorsum and related severe septal deformity).* ***(d)*** *Postoperative anterior view.* ***(e)*** *Polymeric clay cast of reconstruction.* ***(f)*** *Postoperative lateral view: (Extracorporeal septum correction, spreader grafts harvested through septum, Camouflage graft added by septal cartilage, deep temporal fascia graft laid under nasal skin).*

Distal cartilaginous grafts such as auricular and rib grafts are preferred in repair of osteocartilaginous defects in rhinoplasties where septal cartilaginous reserve is insufficient. In places where durability and resistance is essential such as nasal dorsum and septum, costal cartilage is preferred. In places where softer support and pliability is necessary, auricular cartilage is preferred. Nevertheless, costal cartilage graft utilization carries the risk of warping. Rolling the auricular cartilage in a shape of cylinder or pipe by suturing the approximating edges dramatically increase the durability. In our series we used pipe shaped auricular cartilage in resistance bearing areas as a strut graft or septal extension graft instead of using a costal cartilage in selected cases.

In the light of above-mentioned information complexities faced in rhinoplasties can be classified by dividing them first into two groups namely the "cohesiveness group" and "non-cohesiveness group." This broad division first enables us to guess roughly the operation time, urges us for more cautious dissection and can direct us weather we will need distant cartilage grafts or not, because the deformities listed in the "cohesiveness group" are almost always associated with neighboring cartilage insufficiency.

Evaluation of a case through the above-mentioned classification of factors causing complexity can be more accurate than subjectively dividing the rhinoplasty into simple and complex. Rating those factors of complexity provides better clarification and more objective numerical estimation of difficulty of each specific case. If in any case the sum of difficulty coefficients mentioned in Table 1 is between 1-3, the rhinoplasty can be regarded as mildly complex. If the sum of difficulty coefficients is between 4-7, the rhinoplasty can be regarded as moderately complex. If the sum of difficulty coefficients is more than 7, the rhinoplasty is severely complex. This classification can provide a standardization of operations based on difficulty for future studies.

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