

Decision making in nasal implantations by autogenous, synthetic, or mixed implant units: surgeons and patients needs and satisfaction based protocol

Tomada de decisão em implantes nasais por unidades de implante autógena, sintética ou mista: protocolo baseado nas necessidades e satisfação de cirurgiões e pacientes

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RESUMO

Introdução: A tomada de decisão quanto ao melhor implante nasal ainda está em debate e nenhum implante em particular será o ideal, portanto, um protocolo para auxiliar os cirurgiões a decidirem qual é o melhor implante para um determinado problema específico nasal é necessário. Tal protocolo deve ser baseado nas necessidades do paciente e do cirurgião para a melhor qualidade dos resultados e satisfação individual de ambos. **Método:** Muitas técnicas foram realizadas em 32 pacientes com a utilização de três tipos de implante: autógenos, sintético e misto. Os dados observacionais foram coletados para apontar necessidades técnicas e satisfação dos pacientes e cirurgiões, utilizando um escore de interpretação variando de 0 a 2. **Resultados:** Os implantes autógenos foram utilizados na maioria das técnicas, incluindo preenchimento de volume; implantes sintéticos não foram utilizados para camuflagem de irregularidades, modelamento de arestas ósseas, ou cirurgias da ponta nasal, enquanto que os implantes mistos foram utilizados em todos, exceto cobertura de tetos abertos ou irregularidades de superfície delicadas. Aceitáveis efeitos a longo prazo e melhor qualidade dos resultados foram obtidos em 100%, 87,5% e 73% com implantes mistos, materiais sintéticos e enxertos autógenos, respectivamente. Satisfação dos cirurgiões foi máxima quando os pacientes ficaram extremamente satisfeitos (escore = 2), e foi significativamente menor quando os pacientes estavam insatisfeitos em casos com complicações. **Conclusões:** É controverso decidir qual implante é o melhor. Muitos tipos de implante são aplicáveis para mais de um propósito, no entanto, um implante específico poderia ser usado para obtenção de melhor resultado em situações particulares. Considerando-se muitos fatores, um algoritmo é apresentado.

Descritores: Nariz/cirurgia. Próteses e implantes. Rinoplastia/instrumentação.

ABSTRACT

Background: Decision making about the best nasal implant is still in debate and no particular implant will be the ideal one, hence, a protocol to help surgeons decide what is the best implant for a given specific nasal problem is needed. Such protocol should depend up on the patient's and surgeon's needs for the best quality of results and on the individual satisfaction of both of them. **Methods:** Many techniques were performed in 32 patients with using three implant types: autogenous, synthetic, and mixed. Observational data were collected to point to the patients' and surgeons' technical needs and satisfactions using a score interpretation ranging from 0 to 2. **Results:** Autogenous implants were used in most of the techniques including filling volume deficiencies; synthetic implants were not used in camouflaging irregularities, padding bony edges, or in tip surgeries, while the mixed implants were used in all except covering the resultant open roofs or fine surface irregularities. Acceptable long term effects and best quality of the results were 100%, 87.5%, and 73% in mixed implant units, synthetic materials, and autogenous grafts, respectively. Surgeons' satisfaction was at maximum once patients were maximally satisfied (score=2), and was significantly lower while patients were dissatisfied in cases with complications. **Conclusions:** Preoperative embolization in our patients was not determinant It is controversial to decide which implant is the best at all. Many implant types are applicable for more than a job, however still a specific implant could be used for a better job at a time. With consideration of many factors a concerned algorithm is presented.

Keywords: Nose/surgery. Prosthesis and implants. Rhinoplasty/instrumentation.

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INTRODUCTION

There was a general consensus in the different ancient cultures about the facial harmony and the nasal aesthetics in both sexes (Figure 1). Although this consensus seems to be still valid nowadays, however, the plastic surgery community is still in debate about the used implants in rhinoplasty interferences to validate this harmony.

The nasal augmentation is a challenging task in both the reconstructive and the aesthetic settings, and surgeons have used a wide variety of graft materials to perform augmentation rhinoplasty¹. A thorough understanding of the available materials is important for providing the best outcome to our patients.

The materials can be classified into two main categories: autologous and non autologous. Among autogenous options, cartilage has a prominent position because of its physical properties and because it is easy to obtain. Septal cartilage is the ideal autologous graft for its ease of harvest and its structural strength and once it is not available or not sufficient, conchal or costal cartilage grafts would be employed. In some instances, adipose and fascial tissue transplantations are newly employed autogenous tissues.

A wide range of alloplastic material including Gortex, Silastic, Prolene mesh, and Medpor, has been employed in nasal reconstruction and augmentation.

We did combine the conchal and septal cartilage grafts with Prolene or Surgicel sheets as a new categorization and a new introduced term in the nasal implantation methodologies; mixed implant units.

Decision making about the best nasal implant is still in debate and no particular implant will be the ideal one, hence, a protocol to help surgeons decide what is the best implant for a given specific nasal problem is needed. Such protocol should depend up on the patient's and surgeon's needs for best quality of results and on the individual satisfaction of both of them. Many other factors including implant safety, performance, durability, availability, technical simplicity and quality of long-term results should be considered in such protocol. This is the hypothesis of this observational study to correlate the above factors to present an acceptable algorithm for both the surgeons and their patients.

Figure 1 – A: Aesthetic pleasant female nose in ancient Egypt as of the Egyptian queen Hatshepsut, 1508 – 1453 bC, Hatshepsut temple, Luxor; **B:** Male facial and nasal harmony in the old Greek sculptures as of Alexander III, 356 – 323 bC, Louvre museum (nose artistically reconstructed), Paris.



METHODS

Twenty two females and ten males were enrolled in this study. From December 2007 to December 2011, 14 patients were admitted and operated in the authors' affiliation and 18 patients were recruited from other health sectors. No one of our patients had a systemic disease, immune status problems, or diabetes mellitus as they considered in-risk patients. The study had the approval and complied with the rules of the local ethical committee of Assiut University (Assiut, Egypt).

There were different encountered problems in this cohort as: broad nose (n=8), deep radix (n=5), saddle nose (n=5), traumatic distortion (n=4), traumatic twist (n=3), bony hump (n=5), and bony and cartilaginous hump (n=2). Open rhinoplasty approach was applied for all patients but three who had been operated by the closed method. According to the clinical findings, patients' complaints and needs, and the authors' assessment and their objective plans; many techniques were performed in our patients and most of those patients had been presented to more than one surgical modality as indicated (Table 1). Photography, anesthesia, incisions, sutures, splints, dressings, and medications, were applied as well known in these interferences.

Three implant categories were used: autogenous, synthetic, and mixed. Such implants were applied for some tip interferences once indicated and also functionalized to do nasal dorsum jobs as, camouflage of fine or coarse surface irregularities, padding fine or sharp bony edges, covering slit or wide open roofs, or filling volume deficiencies. The autogenous implants included septal cartilage, conchal cartilage, and dermofat composites. The used synthetic implants were Medpor, Silastic, and Prolene mesh. The mixed implant units are autogenous cartilage grafts included within synthetic material sheets to form a block as: cartilage pieces wrapped in Surgicel sheets and cartilage rods rolled in Prolene mesh sheets (Figure 2). The applied implants were initially determined according to the preoperative expectations of the surgical field, but the patients were informed that it is liable for change if there are new intra-operative findings.

Observational data were collected to point to the surgeons' technical needs and their comment as simplicity in obtaining the used implant, its performance as regard shaping and application, its durability and longevity, and

Table 1 – The different applied surgical interferences in the series.

Surgical procedures	N
Osteotomy	11
Hump resection	8
Submucosal septal resection for graft donation	8
Submucosal septal resection for managing deviation	4
Dermofat composite harvesting	4
Conchal cartilage harvesting	12
Submucosal turbinectomy	3
Adenoidectomy	2

the short term effects. Data also included the patients' comments and their needs as the long term effects and the quality of the final results respectively. The surgeons' satisfaction were interpreted in a score ranging from 0 to 2 (2= satisfied, 1= improved, 0= dissatisfied) according to the achieved aesthetic improvements of the satisfied patients, and re-interpreted according to the recorded patients' dissatisfaction in cases with complications. The same satisfaction protocol was applied to the patients.

RESULTS

The patients' ages ranged from 18 to 34 years (average: 24.3 years). The patients showed good evolution in the early postoperative period and were initially satisfied in terms of aesthetics and functionality. Figures 3, 4 and 5 show some results of autogenous, synthetic and mixed unit implantations respectively.

The autogenous implants were used in most of the technical steps performed in this series including tip techniques, camouflage of surface irregularities, padding of bony edges, covering open roofs, and filling volume deficiencies (Table

2). The synthetic implants were not used in camouflaging irregularities, padding of bony edges, or in tip surgeries, while the mixed implant units were used in all except covering the resultant open roofs or fine surface irregularities as those two types were mainly applied for filling volume deficiencies. Some of the autogenous graft slices used for the mixed units was independently applied for tip and columellar applications (Figure 6). The individual Prolene mesh sheets were also used over the main unit to add augmentation as shown in figure.

Conchal or septal cartilage grafts were harvested for a nasal dorsal application once there is also an indication for tip interferences in the same case. Consequently such grafts were used in more than one application as seen in Table 2. The mixed implant units were mainly used to fill volume although also applied in many other indications. The main application of the synthetic implants was filling significant volume deficiencies, and the only extra-indication was covering open roofs.

There were no short term complications such as infection, reaction to foreign body, and graft extrusion. Resorption and deviation were reported as one case each, and two cases of cartilage visibility in patients operated with autogenous implants. One case of deviation was reported in a patient with Medpor implantation. No reported complications within the mixed implant group of patients. Acceptable long term effects and best quality of the results were 100%, 87.5%, and 73% in mixed implant units, synthetic materials, and autogenous grafts respectively (Table 3).

Achieved aesthetic and functional improvements, preoperative and postoperative photographs studies were used as a tool to interpret surgeons and patients satisfaction (Table 3). Surgeons satisfaction was at maximum once patients were maximally satisfied (score=2), and was significantly lower while patients were dissatisfied in cases with complications. Surgeons also commented on the simplicity to obtain the implants. Synthetic materials were ready to use with shorter operative time and unlimited supply, while a

Figure 2 – A: Conchal cartilage cut in 1.5 mm x 2 cm rods, Prolene mesh cut in 1 x 3 cm small sheets; **B:** The cartilage rods are rolled within a Prolene mesh. The sheets were laminated and sutured together to form a height of 1.2 mm.

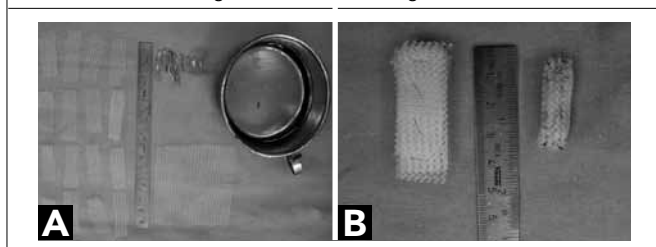


Table 2 – Different applications of each type of the used implants.

Material	Tip techniques	Fine surface irregularities	Coarse surface irregularities	Fine bony edges	Sharp bony edges	Slit open roof	Wide open roof	Mild volume def	Moderate volume def
Autogenous implants (n=15)									
Conchal cartilage (n=6)	3	2	-	2	1	2	-	1	5
Septal cartilage (n=5)	2	1	2	-	3	-	-	2	3
Dermofat (n=4)	-	-	2	-	-	-	-	-	4
Synthetic implants (n=8)									
Medpor (n=4)	-	-	-	-	-	1	-	-	4
Prolene mesh (n=3)	-	-	-	-	-	-	-	-	3
Silastic (n=1)	-	-	-	-	-	-	-	-	1
Mixed implant units (n=9)									
Conchal cartilage as:									
Slices in Surgicel (n=6)	2	-	-	1	2	-	-	1	2
Rods in Prolene mesh (n=3)	1	-	2	-	1	-	-	-	3

Table 3 – Technical comments, short and long term results, and surgeons’ and patients’ satisfaction scores.

	Autogenous implants (n=15)	Synthetic implants (n=8)	Mixed implant units (n=9)
Simplicity to obtain	Extra step	Ready	Extra step
Technical performance	Harvesting and carving	Shaping	Harvesting, carving and wrapping
Short term effects	Good	Good	Good
Mid term effects	Resorption (n=1), deviation (n=1), and visibility (n=2)	Deviation (n=1)	Good
Long term effects	Acceptable in 73%	Acceptable in 87.5%	Acceptable in 100%
Surgeons’ satisfaction score in cases with satisfied patients (0-2)	2	2	2
Surgeons’ satisfaction score in cases with dissatisfied patients (0-2)	1	–	–
Patients’ satisfaction score in cases with satisfied surgeons (0-2)	1	2	2
Patients’ satisfaction score in cases with dissatisfied surgeons (0-2)	–	–	–

Figure 3 – Preoperative view of a case with deep nasal radix before dermofat implantation (A), postoperative view (B).

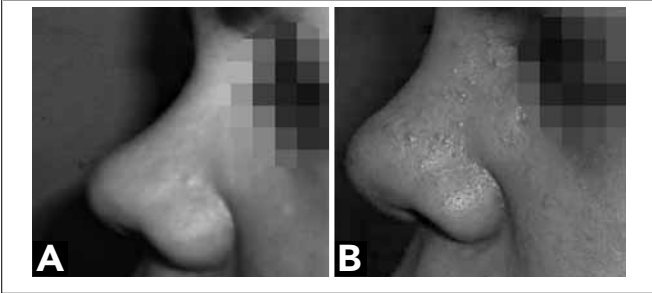
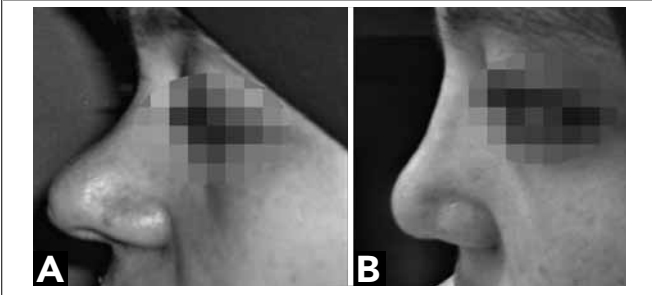


Figure 4 – Preoperative patient view with deep nasal radix (A), postoperative view after Medpor implantation (B).



DISCUSSION

It is very interesting to literately find that many foreign materials have been tried for nasal reconstruction. The first attempt to insert some foreign materials into the nose was reported in 1826 by Von Klein, who tried gold, then Heusser used guttapercha and Tyrrell tried platinum²⁻⁵. In the early

Figure 5 – Preoperative patient view with post traumatic nasal bone loss (A), postoperative view after mixed implant unit implantation as cartilage rods in Prolene rolls and laminated mesh sheets (B).

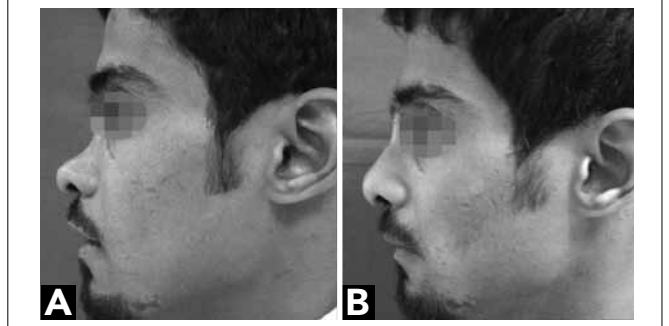
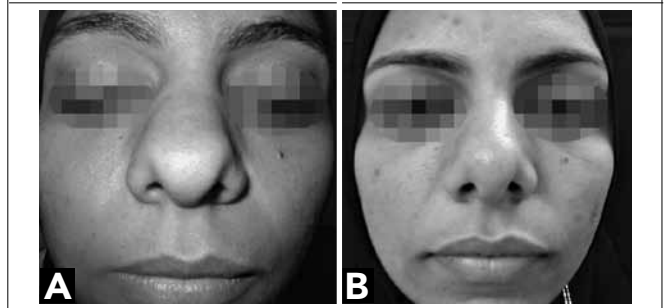
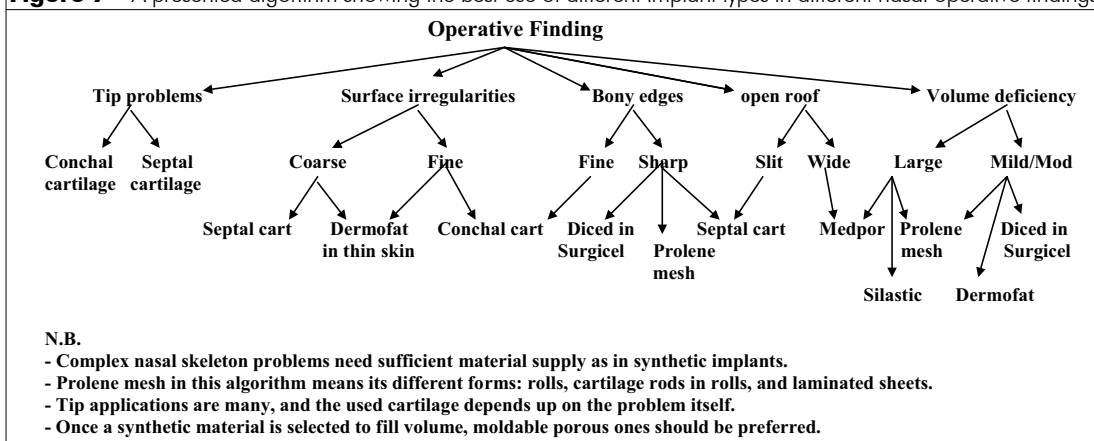


Figure 6 – Preoperative patient view with ill defined broad tip (A), postoperative view after tip surgery and grafting (B).



surgical step or more were needed for autogenous and mixed implants to harvest, carve, re-shape, mix, and/or apply. Patients were mostly satisfied with the highest score grade (score=2) once their surgeons are also satisfied with their results, and absolutely dissatisfied when the surgeons are the same (score=0). In mild complications as resorption or light visibility, patients’ and surgeons’ satisfaction was the same at mid-score level of (score=1).

Figure 7 – A presented algorithm showing the best use of different implant types in different nasal operative findings.

20th century, various investigators tried ivory, paraffin, celluloid, rubber, stainless steel, marble, cork, glass, cobalt alloy, chromium, vitallium, aluminum alloy, acrylic resin, and tantalum⁶⁻⁸. Nowadays, tissue engineering of allografts and stem cells with their regenerative capacity have been introduced to this field. However, many technical details complicate their common use as the high expenses and the highly sophisticated research and laboratory necessities. Moreover, it is mandatory to rule out the presence of infectious diseases in the donor sources.

Autogenous cartilage is still the most appropriate graft material for use in rhinoplasty, as it has biocompatibility, long-term stability and a low complication rate^{9,10}. In most cases, the nasal septum cartilage is considered the best option¹¹. Conchal graft is relatively easy to harvest and has little morbidity; however, it lacks in the strength and the volume needed in extensive defects and reconstructions. In these cases, a rib cartilage graft is abundant and a stronger replacement; however, donor site morbidity is the main drawback¹². Adipose tissue transplantation has been used widely in aesthetic surgery as a surgical method to correct surface depressions or to augment soft tissues and accordingly introduced to rhinoplasty applications¹³. The autogenous implants were used in most of the technical steps performed in this series. They were excellent and compatible with all applications including the small dorsal irregularities observed mainly in patients with thin dorsal nasal skin, the larger problems as sharp bony edges, and compensation of volume deficits. The septal cartilage was more evident in covering sharp edges and coarse irregularities than the conchal cartilage which was excellent in camouflaging fine edges, fine irregularities and for tip and columellar applications. Quality of results including the complications of visibility or resorption was coincident with the reported ones in the literature. Although they need extra surgical steps to harvest and carve, however, the authors were satisfied with their results as most of the patients.

On the other hand, synthetics might be preferred over an autogenous graft to avoid additional morbidity and lengthened operating time. Before surgery, it is important for the surgeon to understand the benefits and limitations of each implant or graft. The ideal graft material would be anti-genically inert,

easy to sculpt, the same consistency as the tissue it replaces, resistant to trauma, non-inflammatory, non-carcinogenic, non-absorbable, and easily available. The nonporous implants prevent tissue ingrowth and this biologic behavior promotes increased implant motility, which can induce chronic inflammation, seroma formation, and possibly graft extrusion^{14,15}. The porous materials as Medpor and Prolene mesh permit rapid and extensive fibrovascular ingrowth, providing fixation and stability. This has repeatedly been shown to render it more resistant to infection than other synthetic implants¹⁶. The synthetic implants were not used in our patients in camouflaging irregularities, padding of bony edges, or in tip surgeries, but used in filling significant volume deficiencies and covering open roofs. There was no preference for them to be applied for other nasal work-ups as tip applications. They were ready to use with shorter operative time and unlimited supply, and need just re-shaping as needed. There was one case of deviation with 87.5% overall patients acceptance and maximal surgeons satisfaction of the long term results.

Mixed implant units, as a new implant terminology, had been obtained through combining autologous cartilage graft slices and Prolene or Surgicel sheets. Wrapping or rolling these grafts in the synthetic sheets of Prolene and Surgicel presented a soft moldable block which used mainly to fill volume deficits but also used independent from the synthetic wrap for tip applications and for camouflaging dorsal irregularities and bony edges after osteotomies, so it may considered the best solution once significant dorsal augmentation and other nose jobs are indicated in one patient. Individual small Prolene mesh sheets in-turn could be also used over the main mixed unit to add volume or correct irregularities if needed. Although these malleable construct units had recorded the longest operative time, however, they presented the best long term results and the maximal patients' and surgeons' satisfaction in the series.

CONCLUSION

It is important to stress that autologous materials remain the preferred graft material for use in rhinoplasty, owing to their high biocompatibility and low risk of infection and

extrusion¹⁷. However, surgeons are commonly obliged to use the alloplastic synthetic materials and sometimes think to combine them in mixed units. Consequently, it is difficult to decide which implant is the best at all: autogenous, synthetic, or mixed ones and this is not the objective of this study. Every kind of them can present some advantages which are not present in the other kinds, and accordingly has some different disadvantages from the others. Understanding every patient needs and objectives and the historical surgeons satisfaction with their older patients are crucial factors to build up a protocol to use these implants. We do believe that when the patient is satisfied mostly the surgeon is satisfied too. The presented algorithm in Figure 7 is showing, from the viewpoints of the authors, the best possible applications for such implants in specific problems. As seen in this work, many implant types are applicable for more than one application, however still a specific implant could be used for a better job at a time.

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