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Wedge resection in rhinosurgery: A review of the literature and long-term results in a hundred cases

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SUMMARY

First a historical review is given of the development of the concept of wedge resection of the bony nasal pyramid since Joseph, 1907. In a second part the technical details about wedge resection are described for different types of nasal deformities. In a third part long-term results in 100 patients, 18 months after septorhinoplasty are presented.

In 61 patients unilateral and in 39 patients bilateral wedge resections were performed as one step of rhinoplasty. The long-term results were good in 93 patients, there was undercorrection in six cases, whereas one patient had an overcorrected nose. These results are better than the long-term results following classic osteotomies alone. Thus the wedge resection, for the indications as defined in this study, is a very useful step in the concept of corrective and aesthetic septorhinoplasty.

In functional and aesthetic rhinosurgery the mobilization of the bony pyramid by means of osteotomies has proved to be a valuable procedure for cases of deviated and/or prominent noses. Since 1907, in addition to the classic osteotomies, a few authors have reported the resection of wedges from the septum and the lateral walls in order to achieve an easier mobilization and postoperative maintenance of symmetry of the bony nasal pyramid.

In studying the rhinologic literature we could only find two papers (Joseph, 1931; Grymer et al., 1982) which briefly mention the final results of this technique. Therefore we would like to present our long-term results with this procedure in a hundred cases and discuss some technical details of wedge resection.

HISTORICAL REVIEW

After Johann Friedrich Dieffenbach's description of some rhinoplastic methods in his textbook "Die operative Chirurgie" (1845) only external incisions and excisions of nasal tissues were used to correct deviated noses.

For instance, Robert Weir (New York), published a case of a displaced nose to the right in 1879: "..... The operator then made an oblique linear incision through the skin at the side of the nose, introduced a fine bone-chisel, and easily cut

through the bone, then tilted it into its place. The nose was now straight, and the incision had entirely healed."

In 1887, John Orlando Roe, an otolaryngologist from Rochester, New York, successfully corrected the enlarged tip of a so-called pug nose in two patients by intranasal incisions. The paper, in which this case was presented is considered to be the first description of intranasal corrective rhinoplasty.

In 1889 Friedrich Trendelenburg from Bonn corrected a deviated nose by applying intranasally lateral osteotomies through the nostrils and transverse osteotomies percutaneously through the skin of the nasal root.

In addition he made paramedial osteotomies to separate the deviated septum and used a fine osteotome to separate the septum from the nasal crest.

The mobilization and reposition of the nasal pyramid was achieved by digital force. To prevent a recurrence he repeated the manual reposition after three weeks and fixed the nose by means of an external bandage.

In 1907 Jacques Joseph from Berlin reported on the successful correction of fixed deviated noses in 23 patients, most of them operated upon in local anaesthesia. Joseph distinguished between congenitally asymmetric noses as a part of a more general asymmetry of the face and acquired deviation mostly due to old unreduced nasal fractures.

Further he made a distinction between cartilaginous and bony deviated noses. Joseph corrected these deviated noses in some of the cases together with hump reduction and submucous septal resection. The lateral osteotomies were made by introducing a saw intranasally and subcutaneously. In five cases with severe bony deviation Joseph recognized the insufficiencies of simple lateral osteotomies which did not prevent recurrences of deviation although he performed the infracture technique. He further noticed the bony "step problem" after lateral osteotomies and saw irregularities due to ossification of the osseous borders in an overriding position. Even with a very forced infracture procedure and very long postoperative external fixation Joseph observed that the noses slowly regained their original deviated position.

Therefore, Joseph tried to avoid these problems by introducing the technique of "wedge resection" in two cases. With a saw he cut a triangle wedge of bone of the long side of the deviated nose. This wedge was taken from the nasal process of the maxillary bone (Figure 1).

In his publication Joseph depicted two wedges of 27 and 25 mm length; one of the operations had an excellent result. In Joseph's book "Nasenplastik und sonstige Gesichtsplastik" (1931) a photograph with 16 wedges from 16 patients is presented. Furthermore, we see some figures with details about how to perform the wedge resection via vestibular incision. To achieve better mobilization after wedge resection Joseph recommends digital force or the use of his "rhinoklast" which helps to shift the nose in the median position where it is fixed by means of

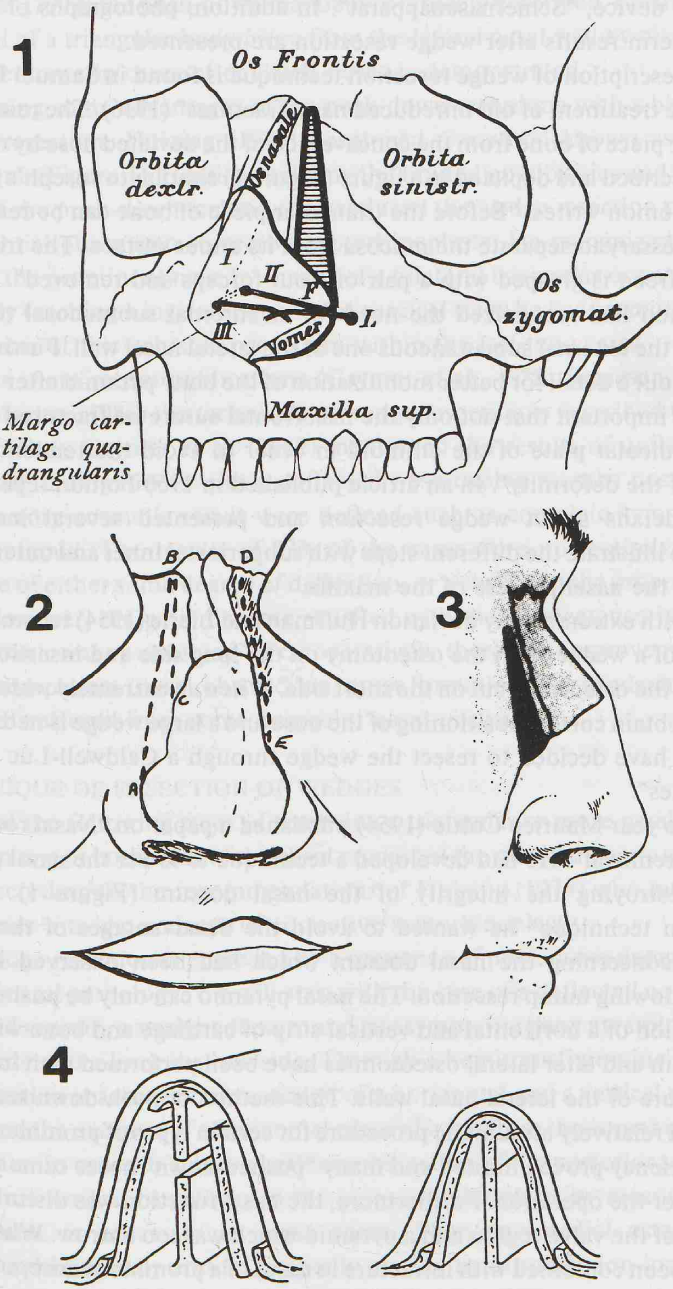

Figure 1. Schematic drawings of wedge resection taken from the publications of 1. Joseph, 1907; 2. Fomon 1936; 3. Huizing, 1975; and 4. a drawing of push-down from Cottle, 1954.

the special device, "Schiefnasenapparat". In addition, photographs of patients with long-term results after wedge resection are presented.

The next description of wedge resection technique is found in Samuel Fomon's article "The treatment of old unreduced nasal fractures" (1936). The resection of a triangular piece of bone from the concave side of the deviated nose by means of a saw is described and depicted in a figure (Figure 1) simular to Joseph's ideas. In addition, Fomon writes: "Before the triangular piece of bone can be removed it will be necessary to separate the mucosa from its under surface. The triangle of bone now freed is grasped with a pair of stout forceps and removed".

Thus, Fomon had recognized the need for an internal submucosal tunnel in addition to the external subcutaneous one of the lateral nasal wall. Furthermore, he pointed out a detail for better mobilization of the bony pyramid after osteotomies: "It is important that not only the nasofrontal suture be fractured but also the perpendicular plate of the ethmoid in order to avoid the tendency to recurrence of the deformity". In an article published in 1960 Fomon repeated the technical details about wedge resection and presented several instructive drawings to illustrate the different steps with subperiostal inner and outer surface tunnels on the nasal process of the maxilla.

For cases with extreme bony deviation Huffman and Lierle (1954) recommended "resection of a wedge from the osteotomy on the long side and insertion of the wedge into the osteotomy cut on the short side. When an extremely wide space is needed to obtain correct positioning of the nose and a large wedge is necessary as a prop, we have decided to resect the wedge through a Caldwell-Luc incision several times".

In the same year Maurice Cottle (1954) published a paper on "Nasal roof repair and hump removal". He had developed a technique to lower the nasal pyramid without destroying the integrity of the nasal dorsum (Figure 1). By this "push-down technique" he wanted to avoid the disadvantages of the Joseph technique concerning the nasal dorsum which had been observed in many patients following hump resection. The nasal pyramid can only be pushed-down after resection of a horizontal and vertical strip of cartilage and bone within the nasal septum and after lateral osteotomies have been performed with infracture or outfracture of the lateral nasal walls. This method of push-down seemed an elegant and relatively atraumatic procedure for certain types of prominent noses, but its efficiency proved limited and many "pushed-down" noses came up some months after the operation. Furthermore, the nasal function was disturbed by a narrowing of the valve region and a pyramid which was too narrow. When push-down had been combined with infracture in cases of a prominent nose, a bilateral paranasal "step" occasionally appeared. Contrary to this, push-down combined with outfracture may produce too much broadening of the nasal pyramid.

In the beautifully illustrated book of Sulsenti "Chirurgia funzionale ed estetica

del naso" (1972) the push-down manoeuvre is nicely described. Furthermore, the removal of a triangular bony piece from the lateral nasal wall by means of a saw and osteotome in cases of deviated noses is demonstrated.
Combining some advantages of the push-down technique with a bilateral bony wedge resection, Huizing (1975) developed a method known as "let-down" technique (Figure 1). Huizing realizing the limited possibilities and the shortcoming of the push-down technique introduced the wedge resection procedure as an essential phase into corrective septorhinoplasty. He recognized its value to correct the prominent nose by means of a bilateral triangular or parallel strip of bone. By teaching a logical sequence of surgical steps he has promoted the widespread use of this valuable procedure within the last ten years.
In some more recent publications (Grymer et al., 1982; Jeppesen, 1986; Jobe, 1981; Mackay, 1986) the technique of wedge resection is described without new aspects. Only Grymer et al. (1982) mentioned the results of unilateral wedge resection in 64 patients with a deflected nose twelve months postoperatively. "Satisfactory cosmetic result were defined such as complete symmetry of the nasal pyramid. The results of 22% of the cases were not entirely satisfactory because of either some degree of deflection, or a change in the proportions of the face. However, the patients were satisfied with their appearance in all but one case, which was re-operated". Postoperatively there was improvement of functional complaints (nasal obstruction, crust formation and headache), although 14% still suffered from some degree of nasal obstruction.

TECHNIQUE OF RESECTION OF WEDGES

Many of the following steps of removing a triangular or more parallel wedge of bone on one or both sides of the nasal process of the maxillary bone are presented here according to the recommendations of Huizing (1975) who integrated this procedure into the concept of corrective septorhinoplasty.
The wedge resection is preceded by a sequence of procedures depending on the type of nasal pathology. We will start with the case of a deflected nose showing a deviated septum, a straight dorsum and an asymmetric bony pyramid with a steep short side and a long shallow side. Through a hemitransfixion incision a septal mobilization is achieved by resection of a horizontal and a vertical cartilaginous strip, and the excision of a horizontal piece of bone from the vomer or perpendicular plate. In order to achieve better mobilization of the posterior septal area an additional vertical osteotomy in the perpendicular plate, by means of a curved osteotome, is necessary in some cases. Then paramedial osteotomies are performed bilaterally and intraseptally via the hemitransfixion incision.
At this stage the wedge resection is carried out as follows:

1. The size of the bony wedge to be resected is outlined on the skin of the long shallow side of the nasal pyramid with surgical ink some millimeters more

cranially to the nasal optic groove. This groove may be identified as the transitionline between the cheek and the lateral nasal wall.

2. A vestibular incision of 8 mm length is made 3 mm in front of the borderline between vestibular skin and mucosa, starting caudally at the insertion of the bone of the inferior turbinate at the piriform aperture.
3. The subcutaneous tissues are spread with blunt scissors to avoid lesion of the angular artery.
4. After reaching the caudal border of the maxillary bones the periosteum of the piriform crest is incised with a knife.
5. By means of a sharp elevator subperiostal tunnels are created on the lateral and then on the medial side of the process of the maxillary bone.
6. A saline soaked "fish" of cotton-wool or gauze is introduced into the nasal cavity to protect the septal mucosa against possible lacerations by the osteotome, especially in the area of the transverse osteotomies.
7. A lateral osteotomy is performed at the cranial border of the wedge to be resected by means of a guarded osteotome or a chisel.
8. A small-bladed speculum of medium length or an "Aufricht hook" is introduced subperiostally and a second osteotomy is made under direct vision at the lower margin of the wedge. If the lateral bony wall shows multiple bony fractures, it may be easier to perform the osteotomy cuts by a saw and a beaver-knife (blade 64).
9. With a fine forceps the wedge is removed in one piece or, if broken, step by step. It is very important to clean especially the canthal corner removing tiny pieces of bone which are sometimes attached to the periosteum.
10. Transverse osteotomies complete the nasal mobilization which enables letdown and medianization of the nasal pyramid, septal reposition or reconstruction, and internal and external fixation of the nasal structures.

The sequence of these ten steps can be applied to noses with other pathological conditions.

In case of a deviated nose with a large hump, the removal of a nearly symmetric hump through the hemitransfixion or intercartilaginous incision can be combined with unilateral wedge resection. The removed hump can be reduced and straightened for reimplantation to close the open roof.

In patients with prominence of the pyramid, the so-called prominent nose or tension nose, the nasal dorsum can be slightly curved or show a marked hump. In addition these types can be combined with deviation of the pyramid to one or both sides.

In case of a symmetrical prominent nose with a slightly curved dorsum the essential step following septal correction is the removal of a symmetrical triangle or parallel strip of bone on both sides of the lateral nasal walls. It is recommended to

complete the resection of these wedges on both sides before the transverse bilateral osteotomies. When the prominence is not too striking it is not necessary to perform paramedial osteotomies before the resection of wedges. When the prominent nose is very narrow these paramedial osteotomies can be done intraseptally without mobilizing the skin of the nasal dorsum. This causes a broadening of the nasal pyramid and will open the narrow valve areas.

If the nose is very prominent, a classic hump resection is combined with a bilateral wedge resection. This combination results in the removal of a smaller piece of hump compared to the classic technique of hump removal in combination with lateral osteotomies. In patients with huge noses the reduction of cartilage and bone may result in an excess of skin, especially in the alar foot. For these cases the bilateral resection of a wedge of skin at the alar base may be helpful to restore the harmony of the nasal proportions.

If the removed wedge or strip of bone turns out to be larger than planned we recommend to reimplant a small strip of bone back into the tunnel between the two periostial layers.

Usually the healing process after wedge resection takes more time than after the classic osteotomies alone. On average, one more week is necessary for the external fixation, especially in the elder patients. Of course, this fact has to be mentioned to the patient preoperatively. It is also very important to find out preoperatively whether the patient wears spectacles. Postoperatively the frame of the spectacles has to be adjusted to the new anatomic conditions, otherwise the original nasal deformity may reappear by the pressure of the spectacles.

RESULTS OF WEDGE RESECTION IN 100 CASES

At the ENT-Department of the University of Ulm 100 patients (51 males, 49 females) were followed-up 18 months after corrective and aesthetic septorhinoplasty. The mean age of these patients at the time of surgery was 25 years, 50% were between 16 and 22 years, i.e. a period in which some nasal structures may still show some growth. 56 patients had a history of midfacial trauma in childhood, and 23 had had previous rhinosurgery once or more than once. The most important indications for surgery were blocked nasal passage in 93 cases, cosmetic wishes in six, and headache in one case.

History, clinical findings of the ENT and orthodontic examinations, values of anterior active rhinomanometry and of olfactometric test, photographs in four standard positions preoperatively and 18 months postoperatively were evaluated together with the data from the surgical reports.

The functional results such as restoration of normal breathing in 95%, no perforations or synechias, 9% dry nasal mucosa etc. will not be discussed in this paper, which confines itself to the long-term results of wedge resection.

In 61 patients unilateral wedge resection and in 39 cases bilateral wedge resection

was performed in one step of the septorhinoplasty. A nasal and/or facial asymmetry was present in 59% of the patients preoperatively.

In Table 1 the results concerning the shape of the corrected nasal pyramid by means of osteotomies and wedge resection are shown for our 100 patients. We found a "normal" pyramid in 93 patients (Figure 2). It is, of course, difficult to define a normal nasal pyramid for patients with facial asymmetry: for these patients (Figure 3) the harmonic bridging of the upper and lower third of the face by a reconstructed nose was taken as "normal".

Table 1. Shape of the corrected nose in 100 patients after wedge resection.

Pyramid	- normal	93%
	- undercorrected	6%
	- overcorrected	1%
Wedge	- not visible and palpable	17%
	- visible	2%
	- palpable	81%

Figure 2. Nasal deformity with left facial hypoplasia in a 17-year-old girl due to untreated trauma at the age of four. Septorhinoplasty with removal of a left bony wedge resulted in a nose of "normal" appearance and function.

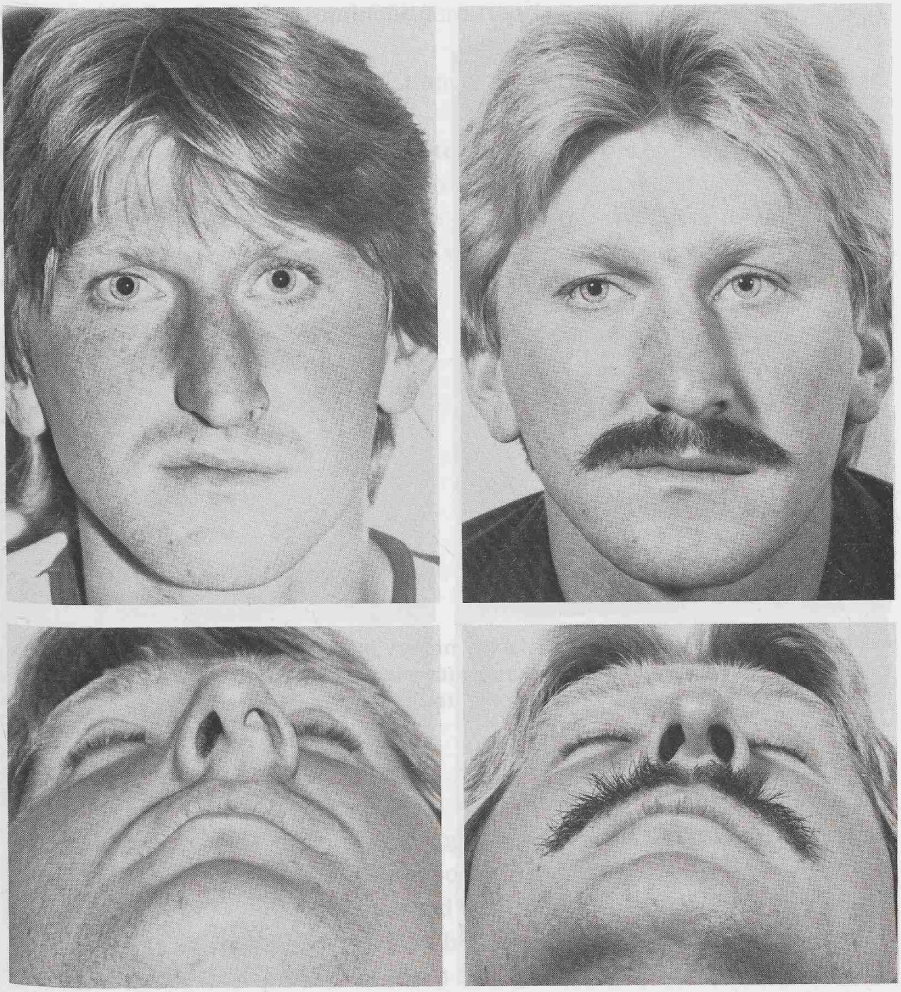

Figure 3. Nasal deformity with facial asymmetry in a 22-year-old man due to untreated nasal trauma at the age of three. Septorhinoplasty with right wedge resection restored nasal function and resulted in a "normal" nasal position in the asymmetric face.

The six patients with undercorrected and one with an overcorrected pyramid belonged to the asymmetric group. Undercorrection (Figure 4) was caused by the removal of a unilateral wedge, which was too small, and most of these failures were made in the period we started this new technique.

The groove of the wedge was visible in two patients producing a deeper shadow on one side of the nasal pyramid.

In two other patients small exostoses were visible in the canthal corner due to insufficient removal of all bony pieces of the wedge. Sensorial disturbances were

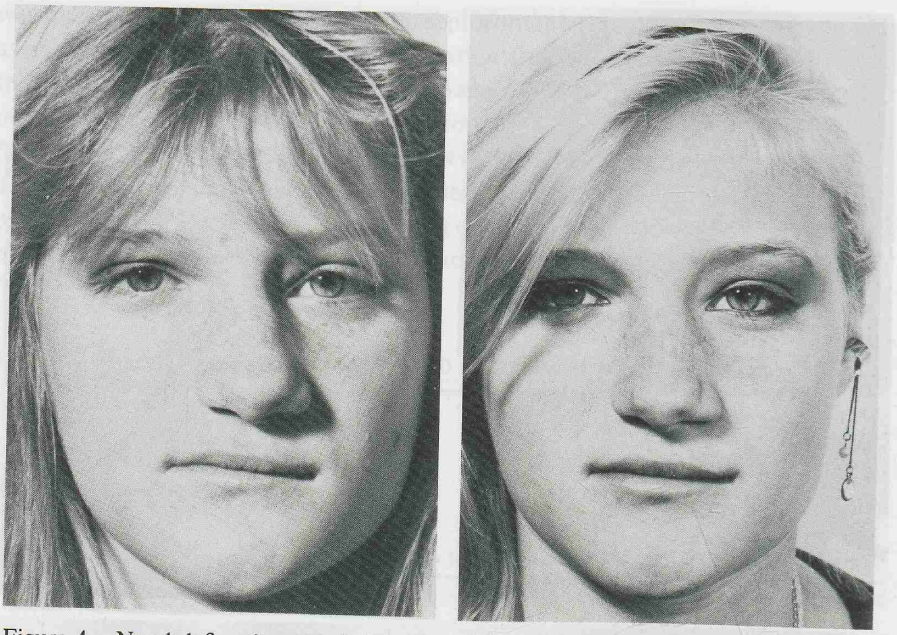

Figure 4. Nasal deformity with facial asymmetry in a 17-year-old girl due to untreated trauma in infancy. Septorhinoplasty with right wedge resection restored nasal function, but left a slight deviation of the bony pyramid to the left (undercorrection).

not found in the area of osteotomies or wedge resection. One troublesome suprise was presented by a patient (Figure 5) who did not tell us that he was wearing spectacles. His corrected nose looked straight and nice when we saw him four weeks postoperatively with a fixed bony nasal pyramid. Two weeks later he came back with his bony pyramid shifted to the left caused by the pressure of his spectacles which had not been adjusted to the new anatomical conditions of his midface. There was no chance to repair the damage. As his nasal breathing was not obstructed, he did not want any further surgical intervention for cosmetic reasons only.

CONCLUSION

Concluding from the literature on this subject and the experience of nearly 300 own cases we can recommend the technique of wedge resection for the following indications:

- Oblique nasal pyramid with asymmetric sides due to injury before the pubertal growth spurt.
- Asymmetric nasal pyramid due to prenatal influences including some malformations like noses in cleft-syndromes, and craniofacial anomalies.

- Deviated or symmetric prominent nose (tension nose).
- Nose in an asymmetric face.
- Nose with recurrent osseous deviation despite of previous paramedial, lateral and transverse osteotomies.

In respect of these indications our long-term results in 100 patients show that the technique of wedge resection results to better functional and cosmetic results than the use of osteotomies only. The only disadvantage is a longer healing period until the bony nasal pyramid is fixed and a special attention must be paid to those who wear spectacles.

Figure 5. Nasal deformity in a 42-year-old man after untreated nasal trauma at the age of eight. Septorhinoplasty with hump removal and right wedge resection. The impression of the bony pyramid in the nasal root area to the left is due to this spectacles which he had not been adjusted to the postoperative anatomical conditions.

ZUSAMMENFASSUNG

Im ersten Teil der Arbeit wird ein historischer Rückblick über die Entwicklung des Konzeptes der Keilresektion am knöchernen Nasengerüst seit Joseph 1907 gegeben.

Im zweiten Abschnitt wird detailliert auf die Techniken der Keilresektion und ihre Anwendung bei unterschiedlichen Nasendeformitäten eingegangen.

Im letzten Teil werden die Spätergebnisse von 100 Patienten 18 Monate nach

einer Septorhinoplastik mit 61 einseitigen und 39 bilateralen Knochenkeilresektionen und die Indikationen zur Keilresektion vorgestellt.
Mit 93 guten Ergebnissen, 6 Unterkorrekturen und 1 Überkorrektur erreichten wir mit der Technik der Keilresektion bei gezielter Indikation bessere Langzeitresultate als mit den klassischen Osteotomien allein, und zwar sowohl hinsichtlich Nasenfunktion als auch der kosmetischen Resultate.

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