

OPERATIVE TREATMENT FOR DEFORMATION OF THE NASAL SEPTUM *

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Operations for deviations and dislocations of the septum have been carried out for many generations and a description of this operation can be found as far back as 1847. The first operative procedures were confined to the most caudal part, which could be seen by direct inspection. With deformation of the more cephalic part of the septum it was necessary to attempt a splitting of the nose or lifting it up as a flap after incision, but such procedures were, of course, carried out only in a limited number of cases.

The first septum operations performed by rhinologists were made without the aid of sight, after palpation of the nasal cavities with a finger. The most prominent parts of the deviation were cut through with a pair of scissors, in such a way, that a crucial incision was formed. A finger was then introduced into the center of the incision and the segments broken at their bases. The surgery of the septum was completed by introducing a powerful compressing forceps, one blade in each nasal cavity, and fracturing the whole septum and bringing it back into a central position. The operation could be carried out in a few minutes under general anaesthesia, however, the postoperative treatment took several weeks and consisted of inserting ebonite dilators into the nasal cavities. These were changed every other day so that the cavities could be cleaned and washed with a disinfectant. The above method was introduced by Asch in 1882 and in a modified form was used by Sluder on children up to the nineteen thirties.

“Fenster resection”

The first septum operation using reflected light and local anaesthesia was carried out by Krieg about 1884. Krieg employed cocain anaesthesia on the mucous membranes, after which they were incised with a galvanocauter, the latter to reduce haemorrhage. The mucous membrane from one side of the septum was cut through above-below and caudally and then completely removed together with the deviated portions of the cartilaginous and osseous septum. On completion of the operation the mucous membrane of the opposite side was retained only, framed by the remaining parts of the septal cartilage and bone. The operation therefore received the appropriate name of window operation or “Fenster Resection”.

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Krieg's operation won a certain amount of popularity in the years up to the change of the century but the method was the object of criticism owing to the large crust deposits and the widespread scar formation, which occurred as a result of the removal of the mucous membrane. The method gradually became modified so that it was considered sufficient to loosen the lamina of the mucous membrane on one side. This was replaced at the end of the operation to cover the remains of the nasal framework. The lamina was either sutured or held in place by a tampon. (Freer, White, Menzel, Zarnico, Weil etc.).

The submucous septum resection.

Several different operative methods were in use at the change of the century for the correction of septum deformities. Some rhinologists used saws or chisels to model the septum whilst others preferred the extremely mutilating Asch method or the newer Krieg's method. A third group completely avoided operative procedures on the septum and preferred the use of the galvano-cautery on the conchae or conchotomy.

This very unsatisfactory state of affairs caused professor Killian of Freiburg to re-evaluate the question of septum operation. He chose as his starting point earlier surgical methods with dissection of the membranes from the septal cartilage and ensured very careful clivage between the cartilage and the perichondrium.

With Killian's method a small curved incision was made in the membrane just behind the anterior edge of the septal cartilage. From the incision the membrane was loosened from the septal framework ensuring careful clivage between the cartilage and perichondrium anteriorly and the bone and periosteum posteriorly. The next step was to cut through the cartilage a few mm behind the front edge and from this point to loosen the mucous membrane on the opposite side from the septal structures. It was then possible to loosen and remove the deflected portions through the original curved anterior incision.

Killian warned against the removal of the whole septal structure and recommended a retention of strips of cartilage under the nasal bridge and in the most anterior part of the cartilaginous septum in order to maintain sufficient stability.

Killian appears to have recognised the very strong connective tissue binding between the membranes and the upper edge of the spine and the vomer. In order to avoid tearing the mucous membrane at this firm attachment he chiseled away a triangular part of the spine and vomer. The splintered bone was removed from between the membranes, in this way Killian obtained access to the tunnels along the spine and vomer at the bottom of the nasal cavities. From this starting point the membranes were loosened from the bottom of the nasal cavities upwards over the upper edge of the spine and vomer, thus it was possible to avoid laceration of the membranes.

The submucous septal operation was the subject of considerable criticism on its publication. The critics emphasized the poor view of the operative field through Killian's incision, which Freer compared to a "buttonhole". They were also afraid of regeneration of the cartilage and bone between the retained

septum blades and that this would result in poor drainage and subsequent haematoma and possibly abscess formation.

Despite the opposition that met Killian's method it was quickly taken up and used in the first place by Ballenger of Chicago. This operator, however, had difficulty in loosening the membranes from the upper edge of the crest and sometimes tore the membranes and at times perforated them. He therefore suggested that it was better to go back to an earlier method of fracturing the nasal crest by inserting a pair of forceps into the bottom of the nasal cavity and rocking the septum between the blades of the forceps, thus breaking the bone loose.

The difficulty in dissecting the mucosa from the nasal crest resulted in Yankaur making anatomical studies of the septal area in order to find an improved operative method. Yankaur found in this way that the nasal crest constitutes a triangular portion of the lower septum. The crest consists of the nasal spine in the front whilst the rear is made up of the vomer which is shaped like a plowshare. The upper edge of this bony crest is a several mm wide rough bony surface with a groove in the middle intended for the lower edge of the septum cartilage. The edge of this groove has a number of irregular serrated bony protrusions pointing upwards and outwards. Some of these lie flat against the cartilage, whilst others point in a lateral direction. They are completely covered by periosteum. In the neighbourhood of the peak of the deviation they occasionally have the form of large pointed spurs or thick blunt exostoses. The cartilage is maintained in position in the groove of the crest by thick layers or strands of connective tissue, which often run from one side of the cartilage to the other, after which they are attached to the bony protrusions. Thus an osteochondrosis is formed which at the same binds the cartilage and bone together and allows a certain amount of and elasticity. The serrations and bony exostoses on the top of the crest

Figure 1.

I. The oldest operations for deviations of the septum were confined to the most caudal part of the septum, which could be seen by direct inspection. The drawing shows a U-shaped incision with loosening of the flap between the perichondrium and cartilage. After removal of the deviated cartilage the mucous membranes on both sides are preserved.

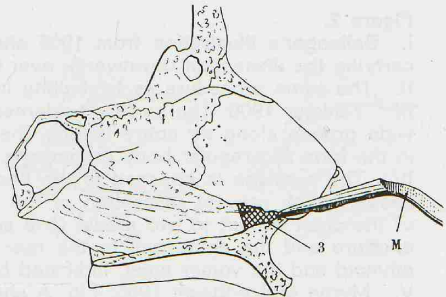
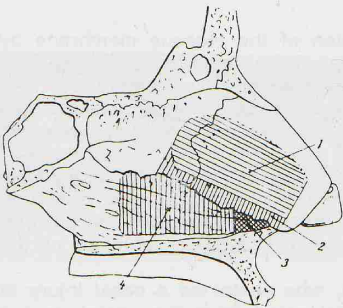
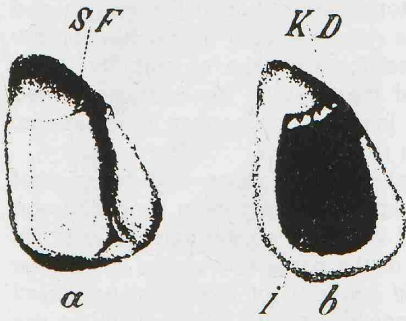
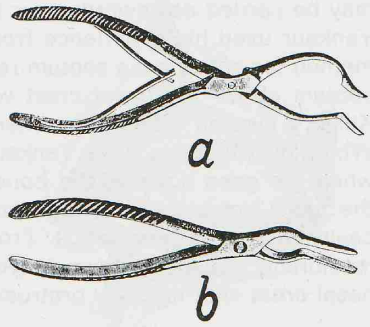
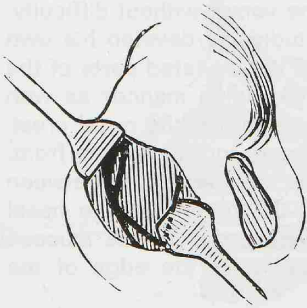
II. Instruments designed by Asch (approx. 1882). Asch used a straight and an angular pair of scissors (a) to make crucial incisions in the septum. The septum was crushed with compressing forceps (b) and brought back to the midline.

III. The method of Krieg (approx. 1884). Krieg incised with a galvanocautery along the dotted line (SF) and completely removed the mucous membrane from one side of the septum together with the deviated parts of the cartilage and bone (a). On completion of the operation only the mucous membrane of the opposite side was retained (b).

IV. Joseph E. Fuld's septum knife. This instrument is both a saw and a knife. The septum was carved and sawn on both sides similarly to a plank being sawn out of a log.

V. Killian's submucous septum-resection (1899). A further development of the method mentioned in no I. ensuring very careful clivage between cartilage and perichondrium in front and between the periosteum and bone at the back. The deviated parts of the septum-frame being removed in the order from 1-4 leaving struts behind the caudal border of the septum and beyond the nasal bridge to stabilize the nose construction.

VI. Killian's method: Killian removed with a special chisel (M) a triangular piece of the spine and vomer (3) in this way obtaining access to the tunnels below the edge of the nasal crest.



become smaller in the rear of the nose and disappear completely between the vertical plate of the ethmoid and the vomer, where a flat elevator may be carried downwards over the suture line to the vomer without difficulty. Yankaur used his experience from his anatomical studies to develop his own method for submucous septum resection. Removal of the deviated parts of the septum above the nasal crest was carried out in the same manner as with Killian's method without any attempt to get over the edge and the nasal crest. When this has been done Yankaur returns to the primary incision in the front, where he goes down to the bone and dissects under the periosteum between the nasal spine and the piriform aperture down to the bottom of the nasal cavity along the bony crest. From this tunnel the separation of the mucous membrane and periosteum is very easily carried out over the edge of the nasal crest with its bony protrusions.

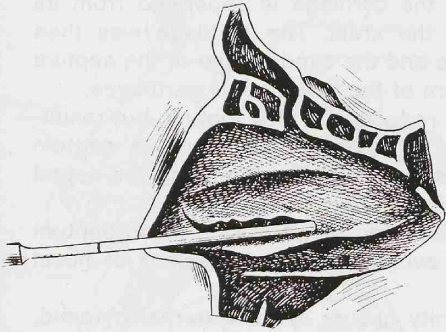
Septoplastic operations

Killian's operative method in Yankaur's modification gradually won acceptance in the majority of E.N.T. departments all over the world. The method had however certain limitations. As emphasized by Killian it was not suitable for children as removal of the septal skeleton could result in hypoplasia and underdevelopment of the outer nose. It was naturally also unsuitable for the cartilaginous struts that had to be retained for the sake of stability under the nasal bridge and at the caudal edge of the septum. The last mentioned location however happens to be the only location for septum dislocations, that cannot be corrected by the submucous resection.

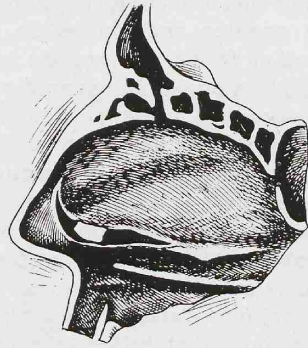
Metzenbaum made a special study of septum dislocations and found that these originated from displacement of the septal cartilage from its anchorage in the groove on the upper edge of the nasal crest. When the osteochondrosis breaks the cartilage will swing out into one of the nares and at the same time a characteristic crookedness, flattening and lowering of the nasal apex will occur. In the early stage, septum dislocations are easily reduced and at the same time the deformity of the outer nose will disappear but at a later stage these dislocations can be extremely difficult to correct. This resulted in Metzenbaum loosening the mucosa from the convex side of the cartilage and

Figure 2.

- I. Ballenger's illustration from 1905 showing laceration of the mucous membrane by carrying the dissection downwards over the upper edge of the nasal crest.
- II. The same procedure as I resulting in perforation of both mucous membranes.
- III. Yankaur 1906: The surface underneath the cartilage presents a rough several mm wide groove along its entire length. The edges of this groove are prolonged upwards in the form of irregular bony projections.
- IV. The cartilage is attached to the bony protrusions by strong strands of connective tissue, which prevent dissection of the mucous membrane downwards over the edge of the crest except in two areas. One area in front in the corner between the piriform aperture and the spine and in the rear at the place, where the vertical plate of the ethmoid and the vomer meet, indicated by arrows.
- V. Myron Metzenbaum 1936: Fig. A shows an infant, who sustained a nasal injury at birth, the lower end of the septal cartilage being dislocated from the septal groove in the floor of the nose. Fig. B. The same infant following the resetting of the dislocated posterior border of the septal cartilage.
- VI. Samuel Fomon: A. Traction forces following submucous resection. B. Sequelae resulting from these traction forces.



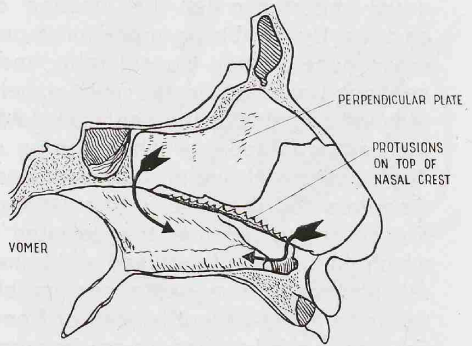
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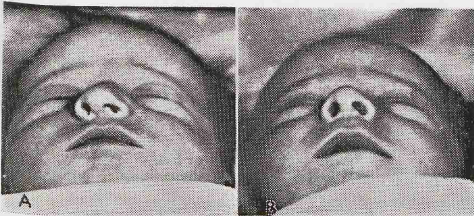
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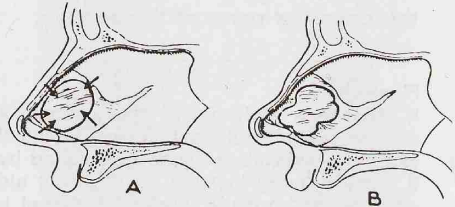
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carrying out an operative reduction in those cases where he could not carry out manual reduction. The lower edge of the cartilage is separated from its false position and placed on the top of the crest. The cartilage was then striped as far as the opposite septum blade and the caudal edge of the septum placed in a pocket between the mesial crura of the lower nasal cartilages.

Metzenbaum's operation was an operative reduction of the septum, but resulted in a simultaneous introduction of the septoplastic procedure in septum surgery, inasmuch as the septum was corrected without sacrificing the septal cartilage.

Metzenbaum's operation was a considerable step forward as it made septum operations on children possible and thus avoided the complications of nasal stenosis in childhood.

With septum dislocations a typical deformity occurs at the external pyramid, a deformity that however disappears on reduction of the dislocation. This observation naturally lead to consideration of the connection between septum deformities and deformities of the outer nose, a causal relation that was the subject of the study by Fomon, who stated that the outer nose is of equal importance for the function of the nose as the septum and nasal cavities. By combining procedures on the septum with reconstructions of the outer nose Fomon considerably increased the requirements for a stable septum. Based upon his own experience he strongly advised against the removal of parts of the septal skeleton, as pockets are thus formed between the septum blades, in which strong scar traction will sooner or later occur. The traction will pull on the nasal bridge and columella resulting in functional disorders and deformity of the nasal pyramid. In order to avoid these pockets Fomon suggested that the deviated parts of the septum be removed after which the pieces of cartilage and bone are cut and remodeled with subsequent reimplantation between the septum blades, possibly supplemented by extra tissue from the patient himself or from the cartilage and bone bank.

Fomons' work has had a very favourable effect and has provided a far better understanding of the coordination between the outer and inner nose, whilst his operative method with reimplantation of the septal skeleton however did not always result in the intended stable nasal septum. It was therefore of considerable interest to find an even more conservative method, that to the greatest possible extent retained the septum skeleton and the active structures in the nasal cavity and at the same time ensured a good blood supply to the operated parts of the septum.

Figure 3.

I. Mosher's drawing of the septum skeleton showing the quadrangular cartilage and its caudal prolongation underneath the nasal spine and behind this the premaxilla with its premaxillary wings discovered by Cottle.

II. The primary incision on the right side of the septum with exposure of the caudal edge of the cartilage, upper left tunnel just commenced.

III. Drawing showing the cartilage resting upon the top of the nasal crest.

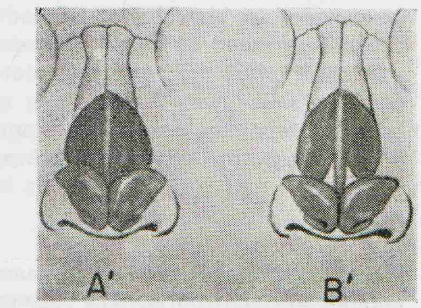
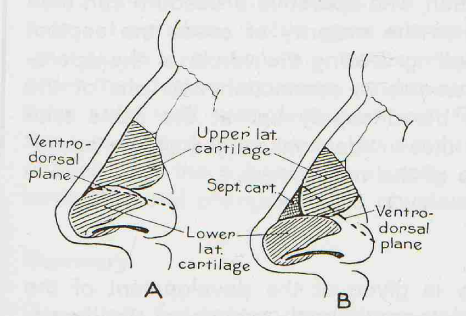
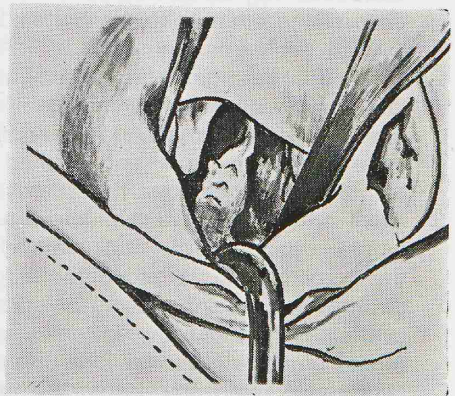
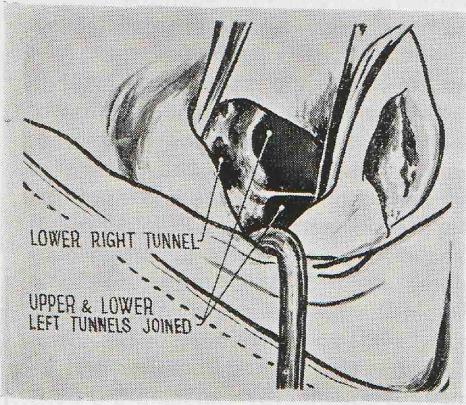
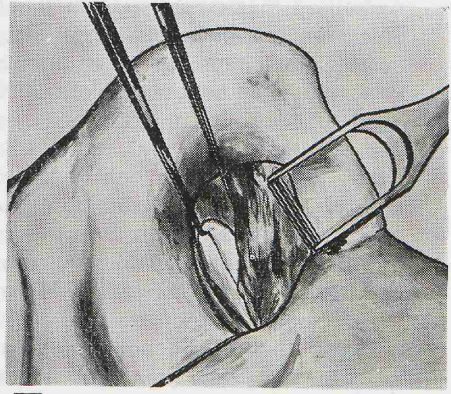
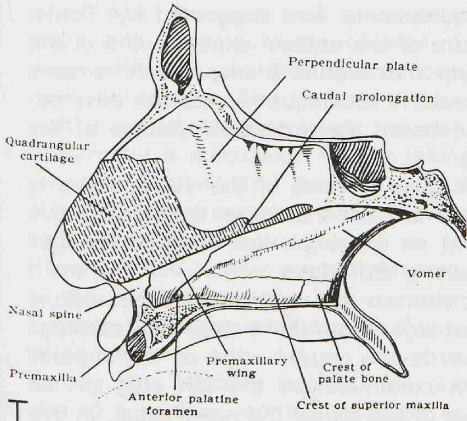
IV. Drawing showing the cartilage after having been displaced from the groove in the nasal crest to the lower right tunnel.

V. Fomon's two types of nasal construction

Type A.: Well developed.

Type B.: Very weak construction.

VI. The two types of nasal construction seen from above.



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A method that complied with these requirements was suggested by Cottle. This provides an unusually good exposure of the septum skeleton and at the same time maintains a blood supply via the septum blade, which remains attached to the septum skeleton. The operative technique is a further development of Yankaur's method and likewise based upon detailed studies of the septum structures.

Cottle has found that behind the nasal spine in front of the vomer there is an extra bone the so-called premaxilla. It is from this bone that the groove starts on the top of the nasal crest, and on this bone the so-called "wings" are situated with the bony protrusions along the edges.

Cottle begins his operation with an incision on the right side of the septum 2-3 mm behind the caudal end of the cartilage. From the incision the cartilage is exposed in a direction forwards towards the caudal edge of the septum, which is by-passed and the dissection continued on the left side of the septum, where the mucosa is freed down to the top of the nasal crest. In this way the left upper tunnel is created. In the rear part of the nasal cavities the dissection may be carried downwards over the suture line between the vertical plate of the ethmoid to the bottom of the nasal cavity on the left side according to Yankaur's method.

Cottle then returns to the original anterior incision in the mucosa and extends this down over the front surface of the nasal spine and the adjacent parts of the piriform aperture. An S-shaped elevator is then placed over the upper edge of the aperture and pushed down at right angles to the bottom of the nasal cavity under the mucosa and periosteum along the sides of the nasal crest. Thus the two lower tunnels are dissected free. The lower left tunnel is joined to the upper left by dissecting from the lower tunnel up over the bony protrusions along the edge of the nasal crest. The cartilage with its fibrous adhesions is cut or scraped from the groove and the lower edge of the cartilage can thereafter be brought down into the bottom of the lower tunnel on the right side. The three tunnels are then joined together and an additional view of the septum skeleton may be obtained by exposing the bony crest on the left side by breaking through between the cartilage and the bone in front of the vertical plate of the ethmoid. At this point a good view of the septum structures is obtained at a time where it has not been necessary to remove any parts of the septum skeleton. The operative procedure can then be directed by the changes found and in the majority of cases the septum can be corrected by chiseling and modelling. During the whole of the operation one half of the septum skeleton remains in connection with one of the septum blades which ensures a good blood supply but at the same time holds together the septum cartilage so that in the final stages of the operation it can be placed "en block" on top of the nasal crest.

Discussion

In the present article a short summary is given of the development of the septum surgery from Krieg's very radical operation with removal of the deviated septum skeleton and the whole of one septum blade to Cottle's very conservative operation retaining the mucous lining and sacrificing as little as possible of the septal structures. If all the "new methods" are examined

it will soon be seen that a comparatively constant development has taken place within the technique of septum surgery such that the pioneers based their methods upon that of their predecessors, however, continually adding new refinements. The technique has gradually been improved keeping step with the increasing demands for stability and normal physiological function. Apparently a discussion is still taking place between the exponents of the resection method and those of septum plastic. At the time of Ballenger the discussion was centered around the necessity of offering completely normal and smooth cartilage in order to remove deviations of the bony septum. Ballenger had to give a positive answer at that time. Since then the exposure of the septum skeleton has become far more complete via Yankaur's and Cottle's technique, and it is in this area that the actual improvements have taken place.

At one time Killian's method was practically dominant in the field and gave rise to a certain uncritical attitude to the operative method. In those cases where a greater or lesser collapse of the outer nasal pyramid occurred this was attributed to the fact that the resection has been too radical. On the other hand a persistent nasal stenosis was attributed to the fact that the operation had not been radical enough. It is in this field that Fomon played his part by pointing out that the pockets which develop between the septum blades after resection can cause very strong traction on the nasal bridge and the columella. This traction can continue for years and sooner or later cause deformities and/or functional disturbances.

By studying the outer nasal pyramid Fomon found very considerable variations. Some nasal constructions have such well developed cartilage that the nasal bridge and ala are so well founded that the stability of the septum skeleton is of little importance. In other cases the cartilaginous skeleton is so weak that it forms the main foundation of the nasal bridge. At the same time the upper lateral cartilage is a correspondingly weak support for the rear edge of the alae causing a tendency to collapsed alae. In the later case even a smaller septum resection or a septum trauma with a fracture of the cartilage can give rise to considerable cosmetic and functional complications.

While Fomon has emphasized the near relation between the septum and the external pyramid, Cottle goes a step further by considering the two nasal cavities as two separate noses, however, with intimate collaboration. In order that this collaboration can be complete the two cavities must be divided by a solid wall, inasmuch as a soft flabby septum will cause a variation in the lumina and changes in the air circulation during the various respiratory phases with the subsequent atrophy or hypertrophy of the mucosa and the turbinates and changes in the physiological activity.

Summary

Operations for septum deviations were originally carried out by general surgeons, who, however, had to limit their procedures to the front part of the septum that could be seen by direct inspection. The first rhinologists were also unable to inspect the nasal cavities and used mutilating procedures, such

as cutting holes in or crushing the septum for a number of years. This was followed by septum resection in the eighties with its extirpation of the deviated parts of the septum. The first method of septum plastic appeared in the nineteen twenties. This operative method attempted correction of the septum by remodelling the septum skeleton in such a way, that the septum was retained as a solid wall between the two nasal cavities.

The discussion on septum resection versus septum plastic gives the impression that these are two entirely different operative methods. One of the original objects in removing the septal cartilage was however, to obtain a view of the bony septal skeleton and sufficient room to loosen and remove the bony deviations.

The history of septum surgery shows a steady development from the older very radical methods with the removal of the septal skeleton and nasal mucosa to the newer very conservative methods with retention of as much as possible of the septal skeleton. This development has occurred in step with the increasing demands of stability and the re-establishment of normal physiological activity in the nasal cavities.

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