

The effects of nasal surgery on the growth of the rabbit snout

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SUMMARY

A series of nasal operations were carried out on groups of four week old rabbits to investigate the effects of septal resection and reconstruction and nasal osteotomies on the subsequent growth of the snout. Resection of portions of the septum with reconstruction using homograft and autograft cartilage caused retardation of snout growth. Nasal osteotomies had little effect on snout growth.

INTRODUCTION

Considerable controversy still exists about the precise role of the cartilagenous septum in the growth and development of the nose and mid-facial structures. The unpredictable long-term results of surgery and trauma on the growing nasal septum (Huizing, 1979; Pirsig, 1979) and the apparently conflicting experimental results in animal work (Sarnat and Wexler, 1967; Stenstrom and Thilander, 1972; Bernstein, 1973; Kvinnsland, 1974; Verwoerd et al., 1979; Nordgaard and Kvinnsland, 1979) have supported the general adoption of a conservative approach to septal surgery in children (Maran, 1979).

Much of the experimental work has concentrated on resection of large areas of septal cartilage, initially without preservation of perichondrium (Sarnat and Wexler, 1966, 1967; Kvinnsland and Briestein, 1973). In 1973, Bernstein pointed out the unphysiological aspects of these more destructive operations and accordingly carried out submucous resection of cartilage without any adverse effect on the growth of the nose. Other more recent experiments, however, have shown that even with preservation of mucoperichondrium (Nordgaard and Kvinnsland, 1979; Verwoerd et al., 1979), resections of large areas of cartilage have caused retardation of nasal growth.

This study was therefore undertaken, first to evaluate the effects of limited submucosal resections with preservation and reconstruction of septal cartilage, in order to reproduce more accurately the results of surgery in children. Secondly, the effects of nasal fractures on growth was simulated by performing osteotomies of the nasal bones.

MATERIALS AND METHODS

In this study a total of 42 New Zealand White rabbits were used in a series of 5 different nasal operations carried out in separate groups of 4 week old animals. In addition, two other groups were included as surgical and non-surgical controls. Under general anaesthesia a midline incision was made down the dorsum of the snout. Using a 2 mm fissure burr, a narrow opening was created down the inter-nasal suture to reveal the dorsal margin of the cartilagenous septum. Portions of the septal cartilage were then removed submucosally, the amount depending on the procedure to be undertaken.

1. *Limited Submucous Resection.* In the first operative group a small central area (mean size 16 × 5 mm) was resected from the base of the septum leaving a dorsal and ventral strut of supporting cartilage.
2. *Homograft.* In the second group the central third of the cartilage was removed and replaced by an identical piece of homograft cartilage taken from one of the other rabbits.
3. *Autograft.* The central portion was removed in a third group and replaced immediately as a free autograft.
4. *Morcellization.* In the fourth group the central third was removed, crushed with a morcellizer and replaced. Because of some elongation of cartilage due to the morcellization, the margins of the cartilage had to be trimmed before being replaced.
5. *Nasal Osteotomies.* In the last experimental group nasal osteotomies were carried out using a 2 mm fissure burr through skin incisions on the dorsum of the snout. The cephalic osteostomy was made immediately caudal to the fronto-nasal suture and the lateral osteotomies down the length of the nasal bones.

In the surgical control group the midline opening in the nasal bones was made in a similar fashion. At the end of each procedure the skin was closed with 4/0 silk.

ASSESSMENTS AND RESULTS

Assessments were carried out five months after the initial operations using photographic, radiological and histological methods.

In the septal surgery experimental groups no obvious disturbance in the growth of the snout was seen until the second postoperative month when about 25% of the rabbits in these groups developed incisor malocclusion. This abnormality was associated with some foreshortening of the snout which was also present in the other animals in these groups. Measurements of the length of the snout were taken from the lateral radiographs and showed similar foreshortening in the nasal bones, the floor of the nose and the maxillary and mandibular alveolus in all four groups as compared with the control animals (Figure 1).

The effect on the height of the snout was, however, less marked. In some cases

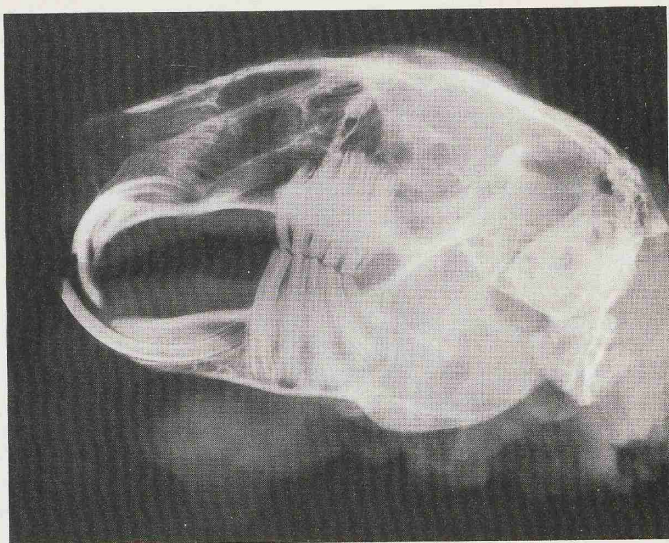


Figure 1. Lateral radiograph showing incisor malocclusion and foreshortening of the rabbit snout following limited submucous resection (group 1).

there was slight saddling of the nasal bones over the operated area and height measurements show minimal loss of tip height.

In the nasal osteotomy group there was no reduction in the length of the snout and height measurements show no significant loss of dorsal height as compared with the controls.

Histological Observations. In the adult animals there was no significant difference between the growth of the homograft and autograft cartilage implants. No histological evidence of rejection or excessive cartilage reabsorption was found nor was there any difference in cellularity between the host and homograft cartilage. Both grafts therefore appeared to have been similarly revitalized and re-established as a growing part of the cartilagenous septum.

There was also evidence of cartilage regeneration following limited submucous resection. Three weeks postoperatively new cartilage can be seen growing from the mucoperichondrium at the margin of the resected cartilage (Figure 2), and in the adult animals the size of the cartilage defect was greatly diminished due to growth of new cartilage. In some animals buckling and overlap of cartilage was evident at the lines of resection which might partly account for some shortening of the septum. However, in most of the adult animals the edges of the cartilage grafts had healed together either by cartilagenous or fibrous union, irrespective of whether they were homograft or autograft implants. In some instances, lamella bone had also been formed at the sites of resection in an apparent attempt to splint the defect.

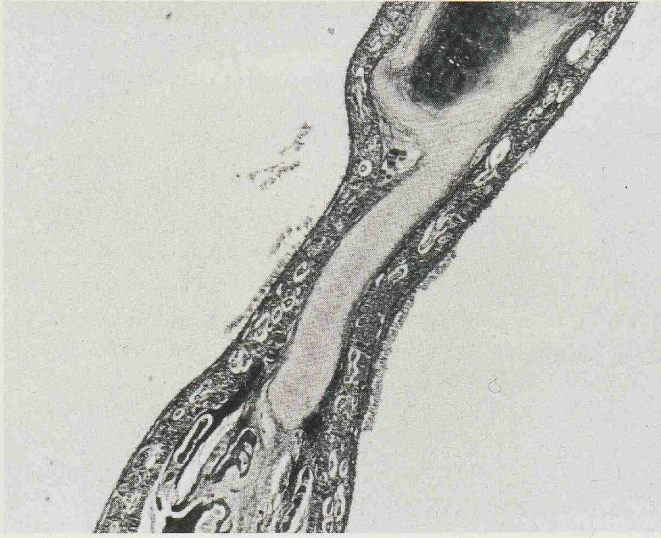


Figure 2.
Tongue of new
cartilage growth
from margin of
resected cartilage
three weeks after
limited
submucous
resection
(group 1).

CONCLUSIONS

In conclusion, these experimental operations have shown that in the growing rabbit:

1. Resection of portions of the septum with preservation of cartilage either by autograft, homograft or morcellized cartilage reconstruction have a similar adverse effect on the growth of the snout. Loss of length and tip height was also seen following limited submucous resection of a central portion of septum.
2. Nasal osteotomies have no significant adverse effect on the growth of the nose and maxilla.
3. Homograft and autograft cartilage implants continued to grow almost proportionately to the rest of the septum and there was no evidence of host rejection of the homograft cartilage.
4. Cartilage regeneration was evident from the perichondrium in an apparent attempt to re-establish the supporting structural role of the septal cartilage.

Although these experiments can not be directly related to septal surgery in children they do show that some adverse effect on the growth of the nose and maxilla may occur with septal surgery, even with conservation of cartilage.

RESUMÉ

Ce travail concerne les conséquences à long terme de chirurgie nasale sur la croissance du museau de lapin. Les résultats de chirurgie du septum démontrent que même avec conservation et reconstruction de la cartilage septale, certains déformations de croissance deviennent apparent.

ACKNOWLEDGEMENTS

This study was carried out with the help of a research grant from the West Midlands Regional Health Authority. The authors would like to express their thanks to Dr. John Frame, Lecturer in Dental Surgery, Birmingham University, to the Department of Surgery (Research), Queen Elizabeth Hospital, Birmingham, and the Departments of Pathology and Medical Illustration at Dudley Road Hospital, Birmingham, for their valuable assistance with the work.

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