Objective: To determine the effects of functional septoplasty on the facial growth of ferrets.

Design: Pilot study.

Setting: Medical center.

Materials: Nine 4-week-old female ferrets.

Interventions: The ferrets were divided into 3 groups of 3. The first group served as the control group and only had bilateral mucoperichondrial flaps raised. The second group had a 5 \times 3\text{mm} piece of septal cartilage removed with preservation of the dorsal and caudal septal struts. The third group had a 4-mm piece of vomer (bone) excised with preservation of all septal cartilage. All groups had the mucoperichondrium preserved. The ferrets grew until 14 weeks of age (well beyond their growth spurt) and were then killed. Lateral cephalograms were then performed and facial analysis conducted to discern any changes in facial growth.

Main Outcome Measures: Facial growth based on cephalometric analysis.

Results: Analysis of variance testing showed no statistically significant differences in facial growth either within or between the 3 groups.

Conclusion: Functional septoplasty has no effect on the facial growth of ferrets.


ASAL AIRWAY obstruction from deformed cartilage or bone is frequently encountered in the pediatric population. Causes of such deformities are frequently traumatic and usually result from birth injuries or falling while learning to walk. Early surgical correction of cartilage and/or bony obstruction is often necessary to reestablish the nasal airway and to avoid secondary nasal deformities. Concern about correcting such deformities either before or during adolescence has been raised because of the potential adverse effect on long-term facial growth. Demonstrating whether certain types of septal deformities (cartilage vs bone) could be corrected safely without altering facial growth would be invaluable to those treating the pediatric population.

Results

Preoperative and postoperative cephalograms were analyzed and the results were compared. Because cephalometric analysis has not been previously described in ferrets, 4 common, easily identifiable points were chosen for analysis. These points included the most anterior extent of the nasal rim (1), the most posterior aspect of the calvaria (2), the most postero-superior extent of the zygomatic arch (3), and the most anterior point of the maxillary alveolar ridge (4) (Figure 2). Data points were derived and statistical analysis was undertaken using the following combination of linear and angular measurements: angle 1-2-3, angle 3-1-4, line 1-2 (in centimeters), line 2-3 (in centimeters), line 1-4 (in centimeters), and line 3-4 (in centimeters). (See above text or Figure 2 for an explanation of the 4 common points of the ferret skull.) Analysis of variance testing was used for analysis because of its ability to account for any preoperative differences between the ferrets. Testing revealed that there were no statistically significant differences in facial growth of the ferrets either within or between groups (Figure 3).
The protocol was approved by the institutional review board of the Madigan Army Medical Center, Tacoma, Wash, and all guidelines regarding animal experimentation were followed. Because septoplasty on ferrets has not been previously described in the literature, a pilot study was undertaken to ensure that this was an appropriate animal model. Nine 4-week-old female ferrets were divided into 3 groups of 3. Prior to any surgical intervention the ferrets were sedated and lateral cephalograms were performed. The ferrets were placed in a head-holding device to ensure uniformity.

Because 4-week-old ferrets are rather small, all procedures were performed using binocular microscopy. The approach to the septum involved a sublabial transverse incision. Elevation of the soft tissues allowed entrance into the nasal cavity and exposure of the cartilage and bony septum. The first group served as the control group and only had mucoperichondrial flaps raised. The second group had a \(5 \times 3\) mm piece of septal cartilage removed with preservation of the dorsal and caudal septal struts. The third group had a 4-mm piece of vomer (bone) excised with preservation of all septal cartilage (Figure 1). All groups had the mucoperichondrium preserved.

Postoperatively the ferrets were allowed to grow beyond their growth spurt to 14 weeks of age. The animals were then killed. Lateral cephalograms were again taken using the same head-holding device. Using points common to all cephalograms, measurements were made and statistical analysis was performed to determine any alterations in facial growth.

Results of animal studies have been equally confusing. Early studies focused on the resection of large amounts of septal cartilage without preservation of the overlying mucoperichondrium. Sarnat and Wexler\(^4\) showed that the production of such defects in young rabbits did, indeed, lead to considerable underdevelopment of the maxilla. Since then, more conservative functional operations have been performed. In 1973, Bernstein\(^5\) carried out submucous resection of cartilage with the preservation of the mucoperichondrium in canine pups and found no growth disturbances. His study, however, did not address the bony septum. In 1979, Nordgaard and Kvinsland\(^6\) and Verwoerd et al\(^7\) found that, despite preservation of the mucoperichondrium, large resections of septal cartilage did, indeed, adversely affect nasal growth. Neither of these studies fully preserved the dorsal or caudal septal struts, which are known to play an important role in supporting the nasal tip.

More recent studies by Meeuwis et al,\(^8\) in 1993, demonstrated that larger resections of septal cartilage caused a shorter and lower nasal dorsum as well as severe septal deviation. Their study, as well as the previously mentioned studies, does not address the osseous portions of the nasal septum and its potential contribution to facial growth.

**CONCLUSIONS**

The ferret is an acceptable animal model for performing functional septoplasty. The procedure itself is technically feasible, although challenging, and the rapid growth rate of the ferret allows for measuring facial growth in a timely manner. Our analysis shows no facial growth disturbances between the 3 surgical groups after functional septoplasty. A larger sample of animals will need to be studied to confirm this conclusion.
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REFERENCES


