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Clinical Paper
Cleft Lip and Palate

Comparison of the effect of the rotation palatoplasty and V–Y pushback palatoplasty techniques on palate elongation with magnetic resonance imaging

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Abstract. Most surgical techniques used in cleft palate repair require the extension of the palate to the pharynx. However, no adequate information exists regarding the extent to which this elongation obtained during operation continues in late postoperative period. In this study, we compared and measured palate elongation in patients with a cleft palate who underwent a V–Y pushback or rotation palatoplasty, by means of magnetic resonance images obtained before and 1 year after surgery. The hard palate, soft palate, and total palate lengths were measured for all of the patients, and the velopharyngeal opening area width was calculated. In patients who underwent the V–Y pushback technique ($n = 13$), the total palate and soft palate lengths were shortened by an average of 0.10 and 0.14 cm after surgery, respectively. However, the hard palate length was elongated by an average of 0.13 cm. In the rotation palatoplasty group ($n = 13$), the total palate, hard palate, and soft palate lengths were elongated by 0.57, 0.10, and 0.49 cm, respectively. The velopharyngeal opening was narrowed by 0.06 cm^2 using the V–Y pushback technique and by 0.29 cm^2 using the rotational palatoplasty. This study demonstrated that the palate does not elongate during the V–Y pushback technique, as expected. However, rotational palatoplasty elongates the soft palate.

Keywords: cleft palate; palatoplasty; V–Y pushback; rotation palatoplasty.

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To normalize the physiological functions of patients with a cleft palate, including speech and sucking, the anatomical disorder must be repaired appropriately. Within the historical development of cleft palate repair, each surgical technique has separated the nasal and oral cavities from one another.[1–14] In addition to this basic surgical goal, several techniques have focused on improving the anatomical repair of the palate muscles.[1–3] Some techniques have been directed towards increasing the palate length,[4–8] whereas others have focused on both anatomical repair of the muscles and increasing the palate length.[9]

The V–Y pushback technique is an effective surgical technique for cleft palate repair and is the first choice in many clinics interested in the treatment of patients with a cleft palate. The rotation palatoplasty is a new cleft palate repair technique developed by the senior author of this article (DI).[9] This surgical technique depends on the principle that the entire soft palate is separated from the hard palate and then the soft palate is turned into a rotation flap that includes the oral mucosa and tensor veli palatini and levator veli palatini muscles. The flap is then extended through the posterior pharynx.

In this study, we compared the palatal elongation and radiological data by means of magnetic resonance images obtained before and 1 year after surgery from patients who had undergone both techniques. We also examined healthy children who had undergone nasopharyngeal magnetic resonance imaging (MRI) for other reasons, to determine the extent of palate elongation due to each of these techniques.

Materials and methods

This study was approved by the local ethics committee. The records of the Plastic, Reconstructive and Aesthetic Surgery Clinic of the Medical Faculty Hospital of Yüzüncü Yıl University were reviewed retrospectively. One hundred and sixty-seven cases of cleft palate repair performed between 2002 and 2012 were retrieved. Between 2002 and 2008, 100 patients were treated with the V–Y pushback and Furlow palatoplasty techniques. Between 2008 and 2012, 67 patients were treated with the rotation palatoplasty technique. If the patients were older than 4 years of age and had undergone cleft palate repair at the same clinic, their palate length and velopharyngeal sphere measurements were recorded using preoperative and postoperative dynamic and static MRI.

An MRI study was performed retrospectively including patients aged 4 to 12 years who had undergone a cleft palate repair with the V–Y pushback technique (Wardill–Kilner) or the rotation palatoplasty technique due to a Veau class 2 cleft palate. The patients had all had an MRI scan before surgery and another at 1 year after surgery. The exclusion criteria were age >12 years, Veau class 1, 3, and 4 cleft palates, lack of a high-quality MRI from which measurements could be performed, and no MRI obtained at 1 year after surgery. The inclusion and exclusion criteria are listed in Table 1.

Among the patients included in this study, 13 had undergone the V–Y pushback technique (group VY) and 13 the rotation palatoplasty technique (group R). To compare the MRI measurements of these patients with those of healthy children, we also examined the imaging findings of patients aged 4 to 12 years who had undergone a nasopharyngeal MRI for other reasons, but who were not diagnosed with any pathology. These patients were included in the study as a control group (group C). Although the patients in group R and group VY each had two MRI of the nasopharynx, one done before surgery and the other at the 1-year follow-up, these measurements were compared to a single nasopharynx MRI from the children in group C. To decrease the analysis errors, each measurement was performed by two radiologists who had no knowledge of the patient group assignments. The results from the radiologists were averaged for each patient, and the data were then analyzed.

Surgical details for the V–Y pushback palatoplasty technique (group VY)

In this surgical technique, a hard palate mucoperiosteal flap is retroposed in the V–Y style, and the cleft palate repair is performed by increasing the anteroposterior length. The palatal muscles (levator veli palatini and aponeurosis of the tensor veli palatini) are dissected from the nasal and oral mucosa and then sutured along the middle, in accordance with the intravelar palatoplasty technique. After V–Y pushback, the raw membranous bone areas remain in the mucoperiosteal flap area. These areas close spontaneously by mucosalization.

Table 1. Study inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Age between 4 and 12 years	Age <4 years or >12 years
Veau class 2 cleft	Veau class 1, 3, and 4 clefts
V–Y pushback and rotation palatoplasty surgery	Surgery by Furlow or other techniques
High quality MRI available	No high quality MRI available
MRI obtained before surgery and 1 year after surgery	No MRI obtained 1 year after surgery

Surgical details for the rotation palatoplasty technique (group R)

This approach uses incisions from the tooth margins and cleft margins, which is similar to the von Langenbeck technique. The mucoperiosteal flaps are elevated from the hard palate. A blunt dissection is made to turn behind the greater palatine artery. The nasal mucosa is then scraped from the back of the palatine bone. The initial surgery performed is the same as for the von Langenbeck technique. After this phase, a periosteal scraper is placed behind the greater palatine artery and a horizontal incision is made to separate the soft palate and hard palate. While making this incision, the surgeon should be careful not to injure the greater palatine artery. The soft palate and the hard palate are then separated from each other. The soft palate flaps are formed, as in the incomplete cleft palate mentioned above, after repairing the nasal mucosa. The oral musculomucosal flaps that were prepared as rotator flaps are rotated and sutured to each other. The soft palate is then sutured to the hard palate.[9,13,14]

MRI

The MRI examinations were performed using a Siemens Magnetom Symphony system (Siemens, Erlangen, Germany) with the following features: a magnet with 1.6 M, a field power of 1.5 Tesla (T), a high magnetic field power, a gradient of 30 mT/m, and a field of view (FOV) greater than 50 cm. To evaluate the anatomical structures and identify additional airway pathologies, measurements were recorded during the resting period, especially those associated with T1-weighted sequences. The following parameters were used: a T1-Weigted Fast Spin Eko (FSE) sequence in the sagittal and axial plane, repetition time (TR)/ echo time (TE):582/10 ms, Flip angle 150 degrees, FOV 300, matrix size 200 × 256, NEX(number of excitations) 2, section thickness 3.5 mm, scan time 20 seconds within the sagittal and axial planes.