Long-Term Results of the Murawski Unilateral Cleft Lip Repair

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Background: In 1968, Ralph Millard published his "Millard II" method for repair of wide, complete unilateral cleft lip and nose deformity. In 1979, Murawski published a major modification of the Millard II procedure in Polish. This motif was taken up 8 years later by Mohler and 22 years later by Cutting. The Murawski variation on the Millard II procedure has become a dominant motif in unilateral cleft lip repair worldwide. This brief report intends to introduce the method to the English language literature and present long-term results.
Methods: The Murawski method alters the Millard II procedure by changing the upper medial curve into a point in the columellar base. This creates a broad C flap used to fill the entire defect produced by downward rotation of the medial lip. Millard's lateral advancement flap becomes unnecessary. A lateral approach to primary nasal reconstruction allows the lateral C flap to be used to construct the nasal floor and sill. The method is described using a physics-based surgical simulator.
Results: Long-term results of the method are demonstrated with four patients with 15 to 25-year follow-up. None of these patients had any revisions to the lip or nose.
Conclusions: The Murawski repair was the first to modify the Millard II repair by sharpening the medial columellar incision, eliminating the need for a lateral advancement flap. This motif was put forth in the years to follow by Mohler and Cutting. Long-term results of the method are presented. (*Plast. Reconstr. Surg.* 149: 254e, 2022.)

In 1968, Ralph Millard modified his original unilateral cleft lip repair method[1,2] for the treatment of wide complete unilateral clefts.[3] In this modification, the upper medial portion of the incision curved up into the base of the columella before descending vertically to end at the top of the noncleft philtral column. This allowed Millard to extend the incision lower if more downward rotation of the medial lip were necessary. The C flap, which had been used to create a nostril floor in the original repair, was advanced up into the nose with the medial crus as part of an extensive primary nasal repair. His lateral advancement flap was retained.

In 1979, Murawski published a lip repair method[4–7] that sharpened the upper portion of Millard's medial incision into a point. This produced a broader C flap that could be used to completely fill the defect caused by the downward rotation of the medial segment. Millard's lateral advancement flap became unnecessary in this design. As a result, the two horizontal incisions under the columella were reduced to one. As its publication was not in English and not in journals widely read in the West, this repair has been largely overlooked. In 1987, Mohler[8] used a related concept with the upper back cutpoint just beyond halfway between the philtral columns. In 2001, Cutting[9–11] extended this idea to the noncleft philtral column as had been done in the original Millard II procedure in conjunction

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Received for publication October 12, 2020; accepted June 2, 2021.

DOI: 10.1097/PRS.0000000000008788

Disclosure: *This work was funded in part by the National Institutes of Health and the National Science Foundation. The authors have no other financial relationships to disclose.*

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with primary nasal reconstruction and nasoalveolar molding.[12,13] Given the widespread use of this motif, the purpose of this brief report is to show long-term results of the Murawski repair and to fill the large gap in the historical development of this mode of unilateral cleft lip repair.

PATIENTS AND METHODS

The Cupid's bow points are marked in the conventional manner, except care is taken to ensure lip height from alar base to the height of the Cupid's bow is the same on the cleft and noncleft sides to prevent a short lip. The skin incisions are diagrammed in Figure 1. Care is taken to place the upper back cutpoint at what will become the midpoint between philtral columns. The C flap is trimmed to completely fill the defect caused by the downward rotation of the medial lip segment. A gingivobuccal sulcus incision is made on the medial side with transections of the depressor septi and alar muscles. In a very large cleft, the septum is detached from the bone inferiorly, allowing the lip and nose to move medially. The upper medial muscle, divided from its attachment to the columella, is rotated down with the lip. A gingivobuccal sulcus incision is made on the lateral side and extended up the piriform aperture and the lateral lip element is freed from the bone, allowing it to advance medially. The lateral lip muscle is dissected extensively and freed from its abnormal attachment to the alar base. The upper end is then rotated down to fill the muscle defect medially. The lateral side of the C flap is advanced into the incision under the alar base to create a nostril sill and lengthen the lateral lip (Fig. 1, *below*, *left*).

The nasal portion of the dissection is diagrammed in Figure 2. The piriform aperture incision is extended up to the nasal bone and the lateral crus of the alar cartilage is detached. This incision is extended into an intercartilaginous incision all the way to the septal angle (Fig. 1, *above*, *center*). [**See Video (online)**, which describes the Murawski unilateral cleft lip and nose repair.] Retrograde dissection is performed over the lateral crus to free it from the overlying skin down to the nostril margin. A suture is placed through the upper edge of the lateral crus at the dome and is brought out through the external skin. This suture and blunt hooks are used to advance the dome up into normal position. The

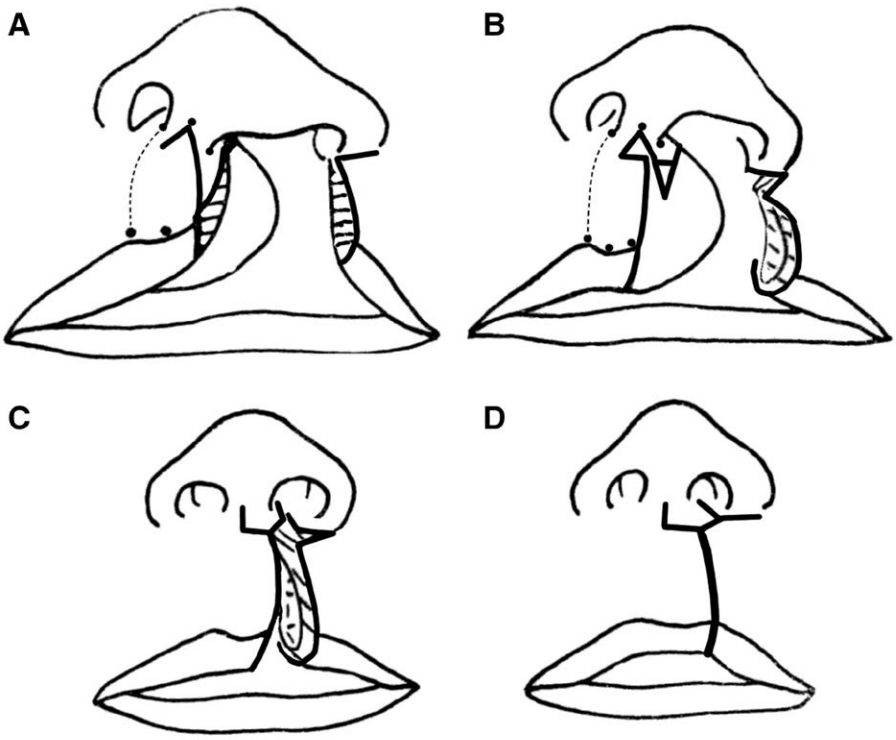

Fig. 1. Lip portion of the Murawski unilateral cleft lip repair. (Adapted from the original Murawsi E. Nowy sposo´b operacji rozszczepu podniebienia pierwotnego opracowany na podstawie badan´ anatomicznych. *Ann Acad Med Stetin*. 1981;18:1–77. Used with permission from the Pomeranian Medical University.)

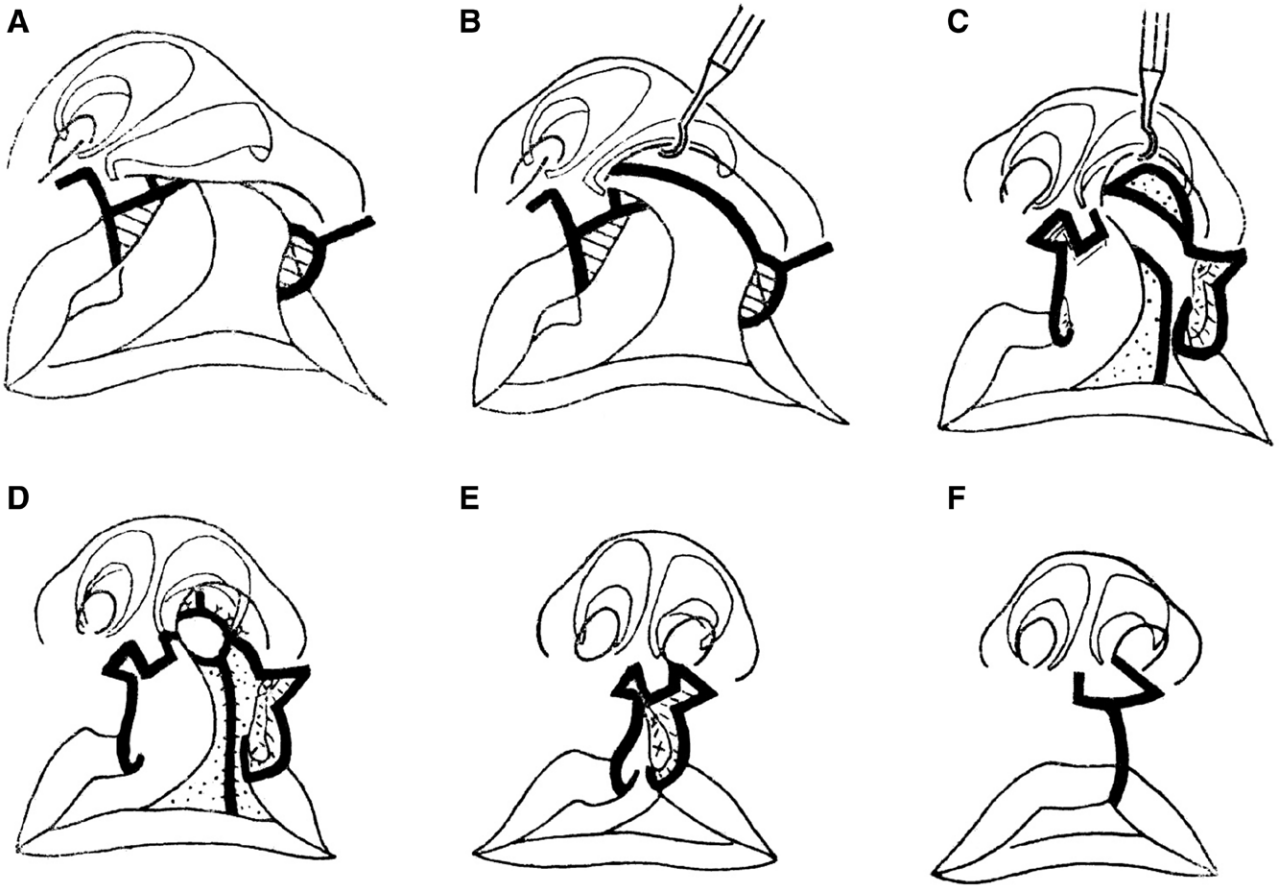

Fig. 2. Nasal section of the Murawski unilateral cleft lip repair. (Adapted from the original Murawsi E. Nowy sposo´b operacji rozszczepu podniebienia pierwotnego opracowany na podstawie badan´ anatomicznych. *Ann Acad Med Stetin*. 1981;18:1–77. Used with permission from the Pomeranian Medical University.)

intercartilaginous incision is closed with the dome in its new advanced position (Fig. 2, *below, left*). A simulation of the procedure performed on a first-order biophysically accurate surgical simulator is shown in the video.

RESULTS

Our original intention had been to conduct a statistical study of long-term lip measurements on a large series of Murawski repairs.[10] Unfortunately, a fire in the Pomeranian Medical University patient archive made this impossible. For this reason, traditional "best case" presentation format was adopted. Figure 3 shows a 15-year follow-up of an incomplete cleft without any revision of the lip or nose since the initial repair. Figure 4 shows a complete cleft 15 years following a Murawski repair with no lip/nose revisions performed. An incomplete cleft with a 25-year follow-up is available. [**See Figure, Supplemental Digital Content 1**, which shows a 25-year follow-up without lip/nose revision (used with permission from Murawski E. Surgery for cleft lip and palate: 50 years experience [in Polish]. *Stand Med Probl Chir Dziec.* 2016;6:138–147), ***http://links.lww.com/PRS/E853***.] A complete cleft with a 17-year follow-up is also available. [**See Figure, Supplemental Digital Content 2**, which shows a 17-year follow-up with no revision to the lip or nose (used with permission from Murawski E. Surgery for cleft lip and palate: 50 years experience [in Polish]. *Stand Med Probl Chir Dziec.* 2016;6:138–147), ***http://links.lww.com/PRS/E854***.] None of these four patients has had any revision of the lip-nose complex and no orthognathic surgery has been performed. Cleft palate repairs have been performed on all patients who presented with palate clefts.

DISCUSSION

Currently, there are two dominant classes of unilateral cleft lip repair separated by the location of the medial back cut used to lengthen the lip: (1) the low back cut class popularized by Tennison[14] and whose current dominant successor

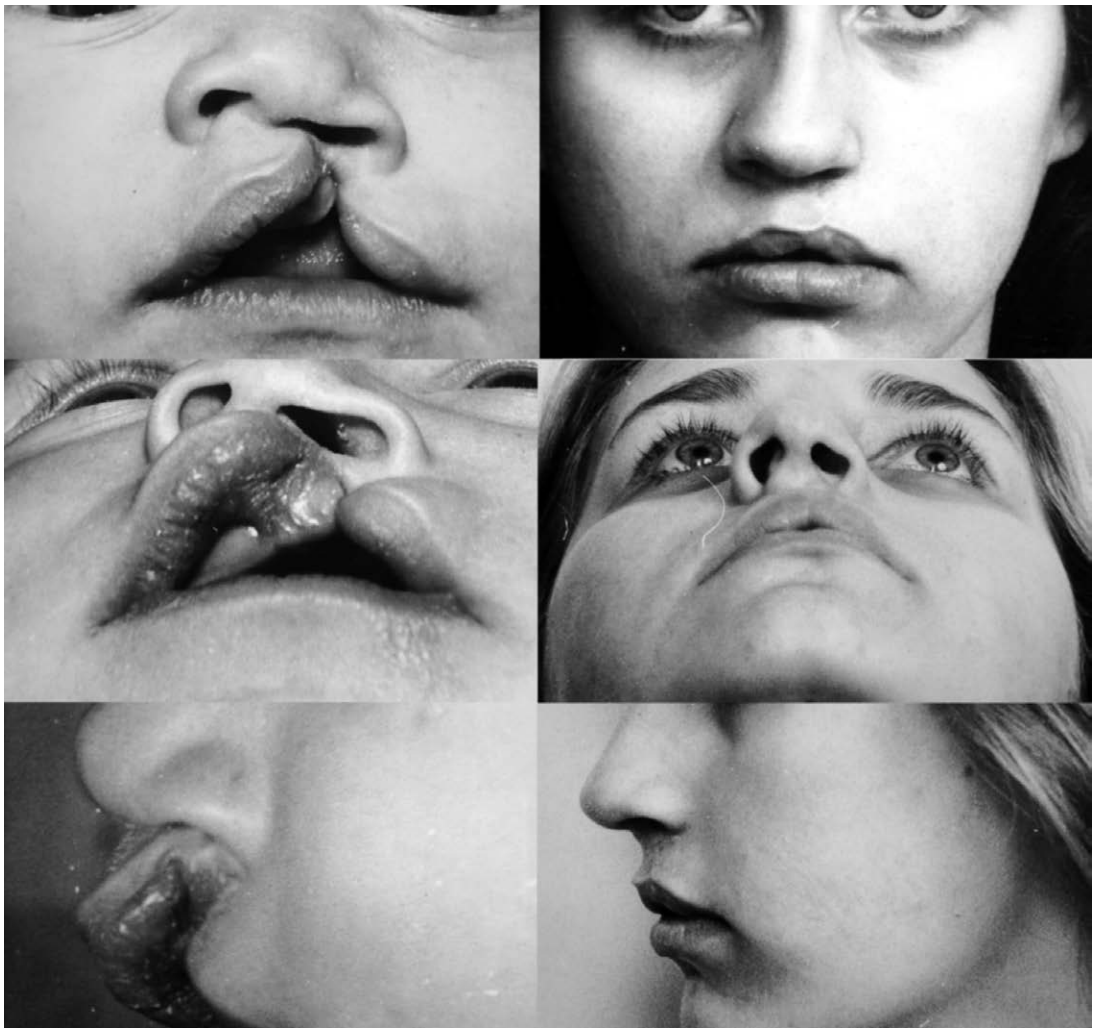

Fig. 3. A 15-year follow-up of a patient with an incomplete unilateral cleft without any revision of the lip or nose since the initial repair. [Used with permission from Murawski E. Surgery for cleft lip and palate: 50 years experience (in Polish). *Stand Med Probl Chir Dziec*. 2016;6:138–147.]

is the Fisher repair[15]; and (2) the upper back cut class popularized by Millard,[1] whose four successors[3,5,8,10] are the subjects of this article. In 1958, Millard[1,2,16] published a new method for repair of unilateral cleft lip that was a radical departure from previous methods that used lower rectangular and triangular flaps to lengthen the short medial lip. By placing his back cut at the top of the lip under the columella, he eliminated the scars in the most visible lower portion of the lip and the flattening of the Cupid's bow that commonly accompanied lower back cut repairs. His original design was developed on incomplete clefts with mild nasal deformity. The original procedure was criticized for producing a small nostril in the complete cleft[17] because of the lateral advancement flap bringing the alar base into normal position while leaving the dome depressed. Declaring his original procedure obsolete[18] in 1968,[3,19] he amended his design for wide complete clefts with severe nasal deformity. The principal change in the new version involved curving the top of his medial incision up into the base of the columella before descending vertically to end at the top of the noncleft philtral column. This allowed him to come down the noncleft philtral column a small amount if more downward rotation was necessary in his "cut-as-you-go" approach.[16] Millard's C flap, which in the original was used to create a nostril sill and floor, was advanced up with the medial crus as part of an extensive primary nasal reconstruction, eliminating the tendency to produce a small nostril. The lateral advancement part of the original repair remained.

As other surgeons took up the Millard II procedure, a small dog-ear on the underside of the

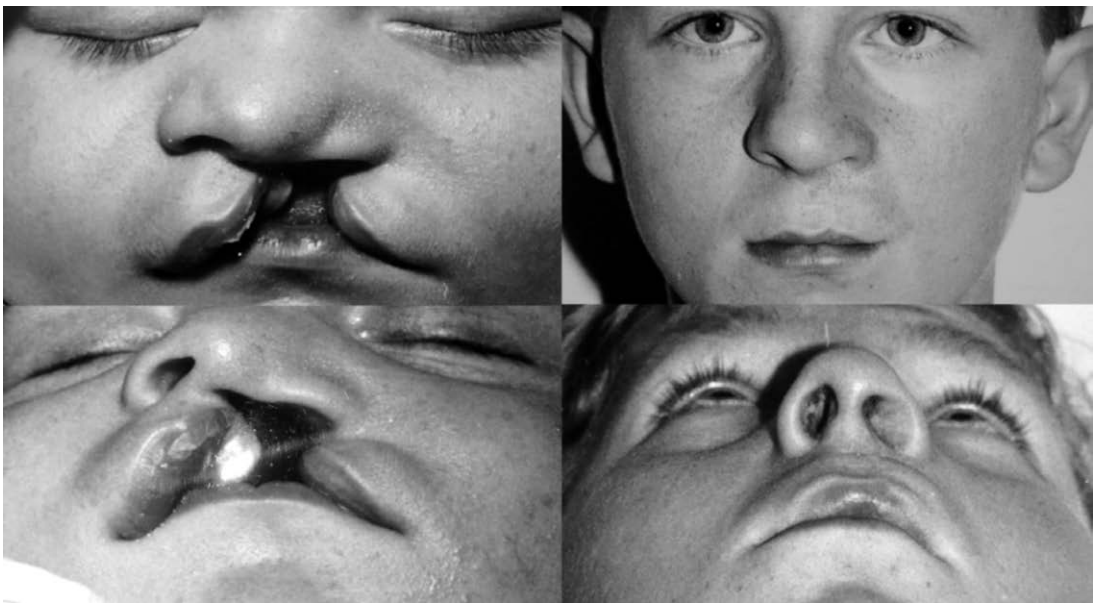

Fig. 4. A 15-year follow-up of a patient with a complete unilateral cleft. No orthognathic surgery and no revision of the lip or nose have been performed since the initial repair. [Used with permission from Murawski E. Surgery for cleft lip and palate: 50 years experience (in Polish). *Stand Med Probl Chir Dziec*. 2016;6:138–147.]

columella was observed and the C flap could become quite narrow. In 1987, Mohler[8] extended Millard's incision up into the broad columellar base, creating a sharp angle at the top. When the medial lip segment was rotated down, this created a single, purely horizontal wound rather than the down-sloping one in the Millard procedure. The sharp angle at the top produced a broader C flap such that it could be turned at a right angle to fill the entire medial rotation defect. The lower half of the C flap was turned laterally to create a nostril sill. This eliminated the need for Millard's lateral advancement flap. As a result, only a single incision crossed Langer lines under the columella rather than two (above and obliquely below the tip of Millard's lateral advancement flap). Mohler's original design only extended slightly beyond halfway to the noncleft philtral column. In his invited discussion of Mohler's article,[20] Millard felt that although this would be adequate for incomplete clefts, it would not allow enough downward rotation in complete clefts. In 2001, Cutting[9–11] extended the Mohler concept to the noncleft philtral column as in a Millard II procedure along with primary nasal reconstruction usually preceded by nasoalveolar molding.[12,13,21–23]

In 1979,[4–7] Murawski published his modification of the Millard II procedure using the motif described in the previous paragraph 8 years before Mohler and 22 years before Cutting. Unfortunately, publication was in German and Polish journals, not widely read in English language surgical circles. For this reason, the Murawski repair has gone largely unnoticed in the mainstream Western surgical literature.[24] The purpose of this article has been to correct this gap in the surgical eclectic of unilateral cleft lip repair and present long-term results of the method.

Differences in primary nasal reconstruction approach account for differences in C flap handling in these methods. In the Millard II[3,19] and Cutting[9,10,25,26] repairs, the focus in primary nasal reconstruction is primarily medial. The back of the C flap incision is extended up the membranous septum, over the septal angle, and extended into an intercartilaginous incision as far as necessary to bring the cleft side dome up into normal position. The medial crura are separated from each other and the overlying skin dissected away from the domes on both sides. Millard used a marginal incision to provide direct access to the cartilages to suture them together in this advanced position. Cutting did not use a marginal incision but sutured the cartilages together in a similar fashion with an internal polydioxanone suture.[25] Because of the need to advance the medial crus up to elevate the dome, the C flap was used purely to elongate the short columella rather than construct a nostril floor. In contrast, Murawski used a purely lateral approach to elevate the depressed dome in his version of primary nasal reconstruction (Fig. 2). [**See Video (online)**, which describes the Murawski unilateral

cleft lip and nose repair.] As the C flap was not advanced up into the columella in the Murawski repair, the lateral part of it could be used to create a nostril sill and floor as was done in the original Millard I procedure and to lengthen the lateral lip. Mohler took an intermediate approach. Half of the C flap was used to elongate the columella and the distal tip turned to create a nostril sill. Mohler appears to have taken a largely medial approach to primary nasal reconstruction, although he does not describe his approach to primary nasal reconstruction in detail.[8]

In the Murawski repair, the vertical height of the lateral Cupid's bow point is set so that the cleft side equals the noncleft side. The distance from the lower edge of the alar base to the height of the Cupid's bow on the noncleft side is measured and matched on the cleft side to set the lateral Cupid's bow point in this repair. This is not Noordhoff's lateral Cupid's bow point.[27,28] Noordhoff felt that this was an anatomical point located at the maximum distance between the white roll and the red line at the junction of true vermilion and inner lip mucosa. In a complete cleft, this invariably results in a lateral segment that is vertically short. Millard would move this point lateral in his cut-as-you-go approach[16] until the lip height was correct. Noordhoff would routinely add a small lower triangle to his version of the Millard repair in this situation.[15,28] Cutting routinely moved the Noordhoff point laterally until the lip height was correct and did not use a lower triangle.[9,10]

The four upper back cut lip repairs discussed in this article thus have four characteristics that differentiate them. These are diagrammed. [**See Figure, Supplemental Digital Content 3**, which shows a comparison of the four upper back cut designs discussed in this article in historical order: (*left*) Millard II in 1968; (*second from left*) Murawski in 1979; (*second from right*) Mohler in 1987; and (*right*) Cutting in 2003, ***http://links.lww.com/PRS/E855***.] The Millard I, Mohler, and Cutting repairs have their back cut point at the lip-columella junction. This places the horizontal portion of the scar between the aesthetic subunits of the nose and the columella. The Millard II and Murawski repairs have a back cut point below the flap. The Murawski, Mohler, and Cutting repairs do not, as a lateral advancement flap is not used. The Murawski and Mohler repairs set the back cut point just beyond halfway to the noncleft philtral column, whereas the Millard I and II and Cutting repairs extend all the way to it to allow more downward rotation. The Mohler and Cutting repairs produce a single vertical scar down the cleft side philtral column which, with their horizontal scar, respect the anatomical subunits of the lip and lip-columella junction and allow downward rotation of the medial lip to be performed with greater ease in more severe clefts, but make the horizontal scar somewhat more visible below the columella. Both Millard repairs have a curving oblique scar at the top of the lip because of the lateral advancement.

This article presents the first use of a surgical simulator to illustrate a surgical technique. Previously, three-dimensional computer graphics animation was used to illustrate cleft surgery both in video clips[11,29,30] and in video game format.[31] Animation is artwork, however, and not bounded by surgical reality. Furthermore, the surgeon is unable to perform the procedure; rather, it is prepared by an animator. The simulator used in this article is first-order biophysically accurate, and the procedure must be actually performed by the surgeon. The online illustration in this article [**see Video (online)**, which describes the Murawski unilateral cleft lip and nose repair] is a recording of a Murawski repair performed on a simulator currently under development.[32,33]

CONCLUSIONS

The Murawski unilateral cleft lip repair was the first to modify the Millard II design by sharpening the medial columellar point, allowing the C flap to fill the entire medial downward rotation defect, thus eliminating the need for the lateral advancement flap. This motif, used in the repairs of Mohler and Cutting, is in wide use today. This is the first article in the English language literature to describe the Murawski repair and present long-term results of its use.

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ACKNOWLEDGMENTS

The work in this article was funded in part by two joint grants from the National Institutes of Health and the National Science Foundation, no. 1763638, "Inverse Anatomical Modeling of the Face for Orthognathic Surgery" (principal investigator: Eftychios Sifakis, Ph.D.), and no. 2008584, "Learning Active Physics-Based Models from Data" (principal investigator: Eftychios Sifakis, Ph.D.).

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