

The Comparison of Different Surgical Techniques Used for Repair of Complete Unilateral Cleft Lip

Linas Zaleckas¹, Laura Linkevičienė¹, Juozas Olekas¹, Nerijus Kutra²

¹Institute of Odontology, Faculty of Medicine, Vilnius University, ²Faculty of Medicine, Vilnius University, Lithuania

Key words: unilateral cleft lip; cheiloplasty; rating scale; late results.

Summary. Up to now, many various techniques have been proposed for the repair of complete unilateral cleft lip. The aim of this study was to compare late results of three different surgical techniques (C. Tennison, R. Millard, and J. Olekas) used for the repair of complete unilateral cleft lip and to analyze their advantages and disadvantages.

Material and Methods. Sixty-six patients with nonsyndromic complete unilateral cleft lip, alveolus, and palate were examined. For 19 patients (28.8%), cleft lip repair was performed using the Tennison technique; for 20 patients (30.3%), Millard technique; and for 27 patients (40.9%), Olekas technique. Results were assessed by score, which was given by analyzing standardized photographs of nasolabial triangles. For the assessment, the modified scale according to Mortier and Anastassov was used. Separate anatomical elements – red lip, white lip, scars, and nose – were assessed.

Results. The best appearance of the red lip and white lip was found after the Tennison technique. Scars and nose looked the best after Olekas cheiloplasty. There were no significant differences in the evaluation of red lip and nose appearance comparing all three analyzed surgical techniques ($P>0.05$). Tennison technique showed significantly better results in the appearance of the white lip ($P<0.05$); the appearance of scars was significantly better after the Olekas repair ($P<0.001$).

Conclusions. Height of white lip and symmetry of the Cupid's bow were better restored by using the Tennison technique. The physiological configuration of the white lip and less visible scars were achieved by using the Olekas technique. All techniques were equal in red lip and nose formations.

Introduction

Cleft lip, alveolus, and palate are the most common congenital anomalies of the face. The ratio of these anomalies in different populations varies from 1:286 to 1:1235 (1, 2). In Lithuania, this ratio was 1:544 during 1993–1997 (3). Up to now, many various surgical techniques are proposed for the repair of complete unilateral cleft lip. However, each and all these techniques have advantages and disadvantages (4–6). The comparison of results of different methods is complicated because of differences in patients' age at the time of surgery, measurements of the cleft, and time of evaluation. Evaluation of the results of surgery has been suggested to be performed at least some years after surgery.

The methods of evaluation in different studies are also inconsistent: some of them are based on subjective patient's or examiner's satisfaction, and others are based on more objective criteria or digital evaluation of residual deformities. Digital evaluation is performed by measuring postsurgical distances of angles of anatomical structures in standardized postoperative photographs (7, 8), by computerized measurement of nose deformations on standardized photographs (9), or by using a scoring system for the subjective evaluation of postoperative appearance

of the lip and nose (10–12). Another possible reason for a lack of comparative results is the evaluation of postsurgical outcomes in different cleft centers, in which different presurgical and postsurgical treatment protocols are used. The experience of surgeons is also different.

The aim of this study was to compare late results of three different surgical techniques – C. Tennison (triangle flaps), R. Millard (rotations flaps), and J. Olekas (modified G. Pfeiffer or wave incisions with a small triangle flap above the red lip) – used for the repair of complete unilateral cleft lip and to analyze advantages and disadvantages of these three methods.

Material and Methods

This retrospective study was carried out at the Cleft Center, Vilnius University Hospital Žalgiris Clinics. All operations were performed from 1987 to 2000 by two experienced surgeons. In the case of complete unilateral cleft lip, alveolus, and palate, lip repair in this Cleft Center was performed according to the Tennison (from 1987 to 1992, Fig. 1), Millard (from 1990 to 1996, Fig. 2), and Olekas (after 1995, Fig. 3) techniques (13, 14). Other parts of treatment protocol (preoperative and postoperative orthodontic treatment) were the same.

Correspondence to L. Zaleckas, Vilnius University Hospital Žalgiris Clinics, Žalgirio 117, 08217 Vilnius, Lithuania
E-mail: lzaleckas@gmail.com, linas.zaleckas@zalgirioklinika.lt

Adresas susirašinėti: L. Zaleckas, Vilniaus universiteto ligoninės Žalgirio klinika, Žalgirio 117, 08217 Vilnius
El. paštas: lzaleckas@gmail.com, linas.zaleckas@zalgirioklinika.lt



Fig. 1. Lip scar after cheiloplasty according to the technique by Tennison



Fig. 2. Lip appearance after cleft lip repair according to the technique by Millard



Fig. 3. Lip frontal view after cheiloplasty according to the technique by Olekas

One hundred five patients with nonsyndromic complete unilateral cleft lip, alveolus, and palate treated at the same Cleft Center were invited for the evaluation of postoperative results. Syndromic patients and patients who had undergone the secondary surgical correction of the lip and/or nose were excluded. Patients were divided into three groups according to the application of the type of surgical technique (Tennison, Millard, and Olekas).

All patients were photographed in standardized illumination and background using a digital camera Canon 400 D. Photographs in 4 standard projections – *en face*, left and right profiles, and from slightly below (nasomental view) – were taken. All patients and their photographs were coded. In all photographs, only nasolabial triangle (without eyes) was evaluated. The nasolabial areas were projected onto a white screen and estimated in the same illumination. The evaluation was performed using the modified rating scale, which was proposed by Mortier et al. (10). This rating system is constructed based on the principle of giving points to each element characterizing both cleft and nasal deformities (11). The total sum of points demonstrated the level of correction of deformities. The more difficult correction of the secondary deformity of cleft lip or nose, the higher total score is. The rating scale consists of 4 different groups of anatomical elements of nasolabial triangle: red lip, white lip, scars, and nose (Table 1).

Statistical analysis was performed using the statistical program SPSS, version 14.0 (SPSS Inc., Chicago, IL, USA).

In order to verify the reliability of rating scale and to prevent inaccuracy during the rating procedure, nasolabial areas were evaluated independently by two investigators twice with a 10-day interval in the same illumination. The interexaminer reliability (kappa coefficient) was 0.89 and 0.92. In order to equalize results, the mean value and standard deviation were calculated in each group (red lip, white lip, scars, and nose).

The Kolmogorov-Smirnov test confirmed that the null hypothesis (H_0) was true, i.e., the distribution of analyzed data in the interval scale did not differ from normal or Gaussian distribution. Mean values, standard deviation, and confidence interval of difference were calculated. The level of significance for all tests was set at $P < 0.05$.

Results

The follow-up period after cleft lip repair varied between 9 and 24 years. The response rate was 62.9% (66 of the 105 patients invited). In 19 patients (28.8%), the Tennison technique was used during cleft lip repair; in 20 patients (30.3%), the Millard technique; and in 27 patients (40.9%), the Olekas

Table 1. Rating Scale

Anatomical Element	Assessment	Diagram	Points
Red lip (Vermilion)	Bulge		0.5
	Notch		0.5
	Lateral lip too thick		1
	Lateral lip too thin		3
	Defect of the vermillion border		0.5
White lip	Too short		1
	Too long		1
	Cupid's bow and philtrum too narrow or no Cupid's bow at all		4
	Cupid's bow and philtrum too wide		2
	Straight, not on the philtrum border		1
Scars	Straight, depressed		1
	Straight, prominent		1
	Medium quality scar		1
	Poor quality scar		2
	Columella too short		0.5
Nose	Visible subluxation or deviation of the septum		2
	Long sill		0.5
	Narrow sill		0.5
	Columellar base too wide		0.5
	Columellar base too narrow		0.5
	Insufficient wrapping of the ala		0.5
	Excessive wrapping of the ala		0.5
	Deformation of the upper part of the nostril rim		0.5
	Poor position of alar cartilage		1
	High position of the ala		0.5
	Low position of the ala		0.5
	Flat and hypoplastic ala		3

Evaluated by points, the best appearance of red lip and white lip was found for patients with cleft, operated on using the Tennison technique. Scars and nose looked the best after surgeries according to the Olekas technique (Table 2). The distribution of scores with confidence intervals of difference is shown in Figs. 4–7.

However, the analysis revealed that despite better rating of the red lip by the Tennison technique or nose appearance by the Olekas technique, there was no significant difference comparing all three investigated techniques ($P>0.05$). Tennison methodology showed significantly better results in the appearance of the white lip and Olekas technique in the appearance of scars (Table 2).

Table 2. Results of Evaluation of Different Anatomical Elements

Anatomical Element	Surgical Technique	Score Mean (SD)	Significance
Red lip	Tennison	0.58 (0.12)	NS
	Millard	0.9 (0.22)	
	Olekas	0.63 (0.12)	
White lip	Tennison	0.42 (0.13)	$P=0.004$, Tennison vs. Olekas $P=0.045$, Tennison vs. Millard
	Millard	1.45 (0.64)	
	Olekas	1.69 (0.33)	
Scars	Tennison	1.47 (0.22)	$P<0.0001$, Olekas vs. Tennison $P<0.0001$, Olekas vs. Millard
	Millard	1.55 (0.2)	
	Olekas	0.33 (0.11)	
Nose	Tennison	2.25 (0.32)	NS
	Millard	2.48 (0.5)	
	Olekas	1.89 (0.2)	

NS, not significant.

Discussion

Different treatment protocols (preoperative and postoperative orthodontic treatment, different patient's age at the time of the surgery, different surgical techniques) might influence postoperative results (1, 15). In the case of unilateral cleft lip, operations in different cleft centers were performed at the different patient's age varying from 1 month to 1 year, mostly from 3 to 6 months (16). In the present study, all operations were performed at the same Cleft Center, and only two experienced surgeons operated the patients using the same treatment protocol only applying different operative techniques. Therefore, these factors gave the better possibility to compare different operative techniques eliminating the influence of different treatment protocols, patient's age at the time of surgery, and surgeons' experience on the postoperative results.

Up to now, several different methods of the evaluation of cleft lip plasty have been proposed. For this purpose, cephalometric analysis (17), anthropometric studies (18), and subjective tests based on the appearance of cleft lip and nose components

technique. At the time of evaluation, the mean age of patients operated on according to Tennison, Millard, and Olekas techniques was 20.5 ± 3.2 years, 15.2 ± 2.7 years, and 10.5 ± 1.2 years, respectively.

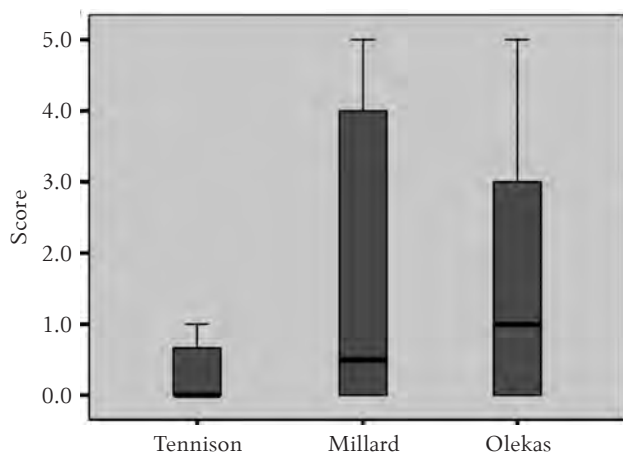


Fig. 4. Distribution of scores in the assessment of red lip

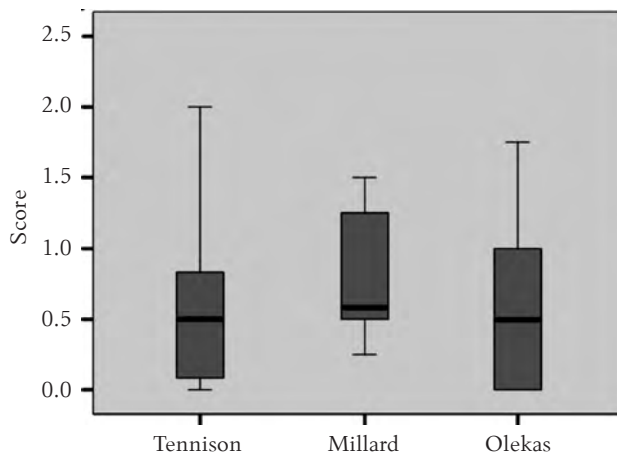


Fig. 5. Distribution of scores in the assessment of white lip

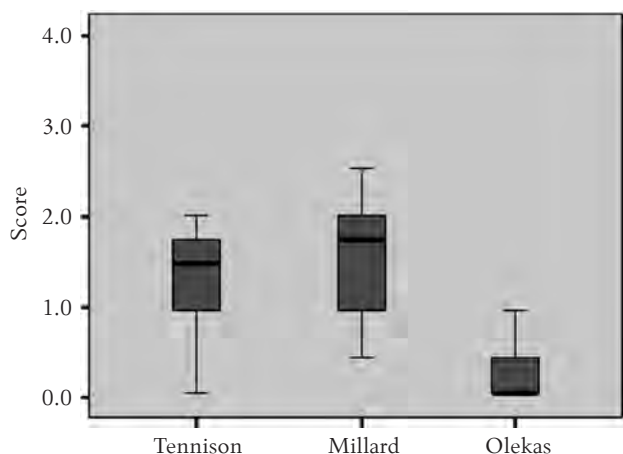


Fig. 6. Distribution of scores in the assessment of scars

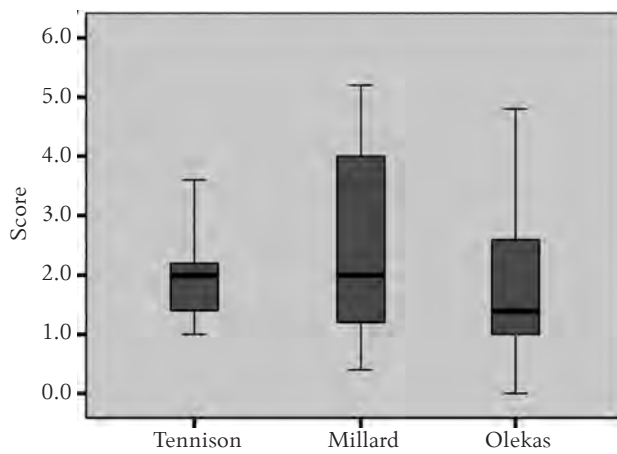


Fig. 7. Distribution of scores in the assessment of nose

(19) are used. The rating scale, which was chosen in this study, is also based on the subjective evaluation of separate anatomical elements in the nasolabial triangle. This scale is closely related to the classification of clefts by the American Cleft Palate-Craniofacial Association (11). Its validity has been already tested in other studies for the lip revision in bilateral clefts, comparing the severity of palatal cleft and the speech results and the results of the primary surgery for incomplete cleft lips (10, 11). The same rating scale is being used in a prospective, randomized international multicenter study "Baltic Cleft Network" (Rostock, Ryga, Tartu, and Vilnius) (20).

Some authors separated wide clefts (8–10 mm and wider) from narrow; other authors incorporated all clefts in one group (12). In the case of wide clefts, cheiloplasty is performed in two steps in some centers. At first, the preliminary lip adhesion (skin and mucosa sutures without muscles) is performed, and only a few months later, the true lip repair with mucosa and skin mobilization and orbicular muscle sutures is done (21). According to the Tennison technique, even very wide clefts are managed by

single operation (22). In the present study, due to limited number of cases, patients were not divided into separate subgroups according to the cleft width. Therefore, the influence of cleft width on esthetic outcomes was impossible to evaluate.

After the assessment of red lip, there was no significant difference comparing all three studied techniques ($P > 0.05$); however, evaluation by separate scores revealed that the worst appearance of red lip was found for patients operated on by applying the Millard technique (Fig. 2). It might be determined by several factors. One of them is insufficient experience of surgeons at the beginning of the use of Millard technique. Until this time, all cleft lip plasties were performed only by applying the Tennison technique. The second factor is that in our center, all cleft lip plasties were performed by single operation, i.e., without preliminary adhesion of the mucosa and skin.

In the assessment of white lip, the patients operated on by applying the Tennison (triangular) technique, as might be expected, showed the best results. This is because symmetry of the Cupid's bow

and reconstruction of vertical lengths of the upper lip and upper vermilion contour are the classic characteristics of the triangular techniques (22). At the same time, the results of Millard and Olekas techniques in this group were almost equal (1.45 ± 0.64 and 1.69 ± 0.33 points, respectively). However, the height of white lip can be easily corrected by secondary plastic surgery, and the advantages of Tennison technique are valid only to this time.

Olekas technique showed the significantly better results in the appearance of scars than other techniques ($P < 0.0001$). This is because after cleft lip repair according to Olekas, scars occur directly on the philtrum border and they are less or no visible (Fig. 3). The change of scar configuration from a triangular-shaped (Tennison technique, Fig. 1) or arch-shaped (Millard technique, Fig. 2) to a straight-line form is practically impossible. From this point of view, Olekas technique, used in our center, becomes an absolute advantage because scars after such operations are less visible, and the upper lip appears to be more physiological.

Lip symmetry in the case of unilateral cleft continues to improve with time after surgery and patient's age. Facial growth and the position of the alveolus process may also influence postoperative results. With regard to surgical outcome and facial growth, some changes in symmetry are very subtle and yet clinically significant (23). However, the main bone growth of the middle third of the face is completed up to 9 years of age, and after this period, the proportions of the middle part of the face changes slightly. The mean age of patients operated on using the Olekas technique was 10.5 ± 1.2 years, and we suppose that different patients' age at the time of evaluation does not have a great influence on the evaluation of results. In addition, according to other authors, despite the fact that a patient with

extremely good results at a young age might look asymmetrical when he or she is older, good results more often remain good and poor results more often remain poor as a child ages (24).

One of the greatest aims in cleft lip surgery is avoidance of nasal deformities (25). There are some data that the Millard technique gives better results in the formation of the nostrils than the Tennison technique (6). The results of this study showed no significant difference ($P > 0.05$) comparing all three analyzed techniques despite the fact that the nose after Olekas technique was rated better. It might be concluded that each technique has advantages but none of these showed significantly better results in the formation of the nostrils.

In the case of primary cleft lip plasty, it would be wise to separate such components as lip and nose. Cleft lip repair directly does not include rhinoplasty, but during primary cheiloplasty, new nostrils are formed, and the relationship of the nasal cartilages is also changed. There is ongoing discussion at what place skin incision in nostril area must be done to mobilize the alar cartilage during primary cleft lip plasty or it must be done during secondary surgery, how and wherewith to fix mobilized cartilages, to use or not to use postoperative stents (26). Further studies are required in order to answer these questions.

Conclusions

Height of white lip and symmetry of the Cupid's bow were better restored by using the Tennison technique. The physiological configuration of the white lip and less visible scars were achieved by using the Olekas technique. All techniques were equal in red lip and nose formations.

Statement of Conflict of Interest

The authors state no conflict of interest.

Visiškų vienpusių viršutinės lūpos nesuaugimų skirtingų operacijos metodikų rezultatų palyginimas

Linas Zaleckas¹, Laura Linkevičienė¹, Juozas Olekas¹, Nerijus Kutra²

¹Vilniaus universiteto Medicinos fakulteto Odontologijos institutas, ²Vilniaus universiteto Medicinos fakultetas

Raktažodžiai: viršutinės lūpos nesuaugimas, vertinimo skalė, lūpos plastika, vėlyvieji rezultatai.

Santrauka. Atliekant visiškų vienpusių viršutinės lūpos nesuaugimų plastiką, iki šiol pasiūlyta daug operacijų metodikų.

Tyrimo tikslas. Palyginti visiškų viršutinės lūpos nesuaugimo plastikų, atliktų trimis skirtingomis metodikomis (C. Tennisono, R. Millardo ir J. Oleko), vėlyvuosius rezultatus, palyginti atskirų operacijų metodikų privalumus bei trūkumus.

Tyrimo medžiaga ir metodai. Ištirti 66 pacientai, gimę su visišku vienpusiu viršutinės lūpos, viršutinio žandikaulio alveolinės ataugos ir gomurio nesuaugimu. 19 pacientų (28,8 proc.) viršutinės lūpos nesuaugimo plastika atlikta taikant C. Tennisono metodiką, 20 pacientų (30,3 proc.) – R. Millardo metodiką, 27

pacientams (40,9 proc.) – J. Oleko lūpos plastikos metodiką. Operacijų rezultatai įvertinti balais, tiriant standartizuotas nosies-lūpų trikampių fotografijas. Vertinimui naudota modifikuota Mortiero ir Anastassovo pasiūlyta deformacijų skalė. Vertintos atskiros sritys: lūpos raudonis, lūpos oda, randai ir nosis.

Rezultatai. Skaičiuojant balais, geriausiai lūpos raudonis ir lūpos oda atrodė po C. Tennisono metodika atliktų lūpos plastikų; randai ir nosies forma buvo geriausi operuojant J. Oleko metodika. Tačiau, tiriant lūpos raudonį ir nosį, nė vienos iš trijų nagrinėjamų metodikų nedavė statistiškai reikšmingai geresnių rezultatų ($p > 0,05$). Tuo tarpu tiriant odą, C. Tennisono metodika pasirodė statistiškai reikšmingai geresnė nei kitos ($p < 0,05$), o randai patikimai geriau atrodė operuojant J. Oleko metodu ($p < 0,0001$).

Išvados. Lūpos aukštis ir Kupidono lanko simetrija geriausiai koreguojami taikant C. Tennisono operacijų metodiką. Taikant J. Oleko metodiką, pooperacinis randas mažiau pastebimas, lūpos oda atrodo fiziologiškiausiai. Visos metodikos buvo lygiavertės formuojant lūpos raudonį ir nosies landą.

References

- Andrā A, Neumann HJ. Lippen-Kiefer-Gaumenspalten. Leipzig: Barth; 1989. p. 299.
- Hsieh EWY, Yeh RF, Oberoi S, Vargervik K, Slavotinek AM. Cleft lip with or without cleft palate: frequency in different ethnic populations from the UCSF craniofacial clinic. *Am J Med Genet A* 2007;143A(19):2347-2351.
- Vasiliauskas A, Utkus A, Matulevičienė L, Matulevičienė A, Linkevičienė L, Kučinskas V. The incidence of cleft lip and/or palate among newborns in Lithuania, 1993-1997. *Acta Medica Lituanica* 2004;11(2):1-6.
- Becker M, Svensson H, McWilliam J, Sarnäs KV, Jacobsson S. Millard repair of unilateral isolated cleft lip: a 25-year follow-up. *Scand J Plast Reconstr Surg Hand Surg* 1998;32(4):387-94.
- Robin NH, Baty H, Franklin J, Guyton FC, Mann J, Woolley AL, et al. The multidisciplinary evaluation and management of cleft lip and palate. *South Med J* 2006;99(10):1111-20.
- Tan O, Atik B. Triangular with Ala nasi (TAN) repair of unilateral cleft lips: a personal technique and early outcomes. *J Craniofac Surg* 2007;18(1):186-97.
- Enemark H, Friede H, Paulin G, Semb G, Abholm F, Bolund S, et al. Lip and nose morphology in patients with unilateral cleft lip and palate from four Scandinavian centres. *Scand J Plast Reconstr Surg Hand Surg* 1993;27(1):41-7.
- He X, Shi B, Kamdar M, Zheng Q, Li S, Wang Y. Development of a method for rating nasal appearance after cleft lip repair. *J Plast Reconstr Aesthet Surg* 2009;62(11):1437-41. Epub 2008 Sep 13.
- Coghlan BA, Laitung JK, Pigott RW. A computer-aided method of measuring nasal symmetry in the cleft lip nose. *Br J Plast Surg* 1993;46(1):13-7.
- Mortier PB, Martinot VL, Anastassov Y, Kulik JF, Duhamel A, Pellerin PN. Evaluation of the results of cleft lip and palate surgical treatment: preliminary report. *Cleft Palate Craniofac J* 1997;34(3):247-55.
- Anastassov Y, Chipkov C. Analysis of nasal and labial deformities in cleft lip, alveolus and palate patients by a new rating scale: preliminary report. *J Craniomaxillofac Surg* 2003;31:299-303.
- Asher-McDade C, Brattström V, Dahl E, McWilliam J, Molsted K, Plint DA, et al. A six-center international study of treatment outcome in patients with clefts of the lip and palate: Part 4. Assessment of nasolabial appearance. *Cleft Palate Craniofac J* 1992;29(5):409-12.
- Olekas J, Spruogis J, Grybauskas S, Olekaitė L. The plastics clefts of the lips. 9th International Congress on Cleft Palate and Related Craniofacial Anomalies, Goteborg, Sweden; 25-29 June, 2001. p. 453-7.
- Olekas J, Spruogis J. Įgimtų visiškų vienpusių viršutinės lūpos nesuaugimų chirurginiai gydymo metodai. (Surgical methods for treatment unilateral total congenital clefts of the lip.) *Medicina (Kaunas)* 1999;35(4):146-51.
- Cohen M, Smith BE, Daw JL. Secondary unilateral cleft lip nasal deformity: functional and esthetic reconstruction. *J Craniofac Surg* 2003;14(4):584-93.
- Tercijonas P. Įgimtų viršutinės lūpos ir gomurio nesuaugimų gydymo problemos. (Problems of cleft lip and palate treatment.) *Medicina (Kaunas)* 1999;35(4):161-4.
- Ross RB. Treatment variables affecting facial growth in complete unilateral cleft lip and palate. Part 4. Repair of the cleft lip. *Cleft Palate J* 1987;24:5-77.
- Williams HB. A method of assessing cleft lip repairs: comparison of Le Mesurier and Millard techniques. *Plast Reconstr Surg* 1968;41:103-7.
- Lindsay WK, Farkas LG. The use of anthropometry in assessing the cleft lip-nose. *Plast Reconstr Surg* 1972;49:286Y293.
- Lenz JH, Akota I, Zaleckas L, Olekas J, Soots M, Gundlach K. Outcome of lip closure in UCLAP results (Baltic Cleft Network). *J Craniomaxillofac Surg* 2008;36:S18.
- Tatum SA. Two-stage unilateral cleft lip repair. *Facial Plast Surg* 2007;23(2):91-9.
- Chowdri NA, Darzi MA, Ashraf MM. A comparative study of surgical results with rotation-advancement and triangular flap techniques in unilateral cleft lip. *Br J Plast Surg* 1990;43:551-6.
- Hood CA, Bock M, Hosey MT, Bowman A, Ayoub AF. Facial asymmetry – 3D assessment of infants with cleft lip & palate. *Int J Paediat Dent* 2003;13:404-10.
- Randall P. Cleft lip. *Clin Plast Surg* 1975;2:215-33.
- Numa W, Eberlin K, Hamdan US. Alar base flap and suspending suture: a strategy to restore symmetry to the nasal alar contour in primary cleft-lip rhinoplasty. *Laryngoscope* 2006;116(12):2171-7.
- Nagy K, Mommaerts MY. Analysis of the cleft-lip nose in submental-vertical view, part I – reliability of a new measurement instrument. *J Craniomaxillofac Surg* 2007;35(6-7):265-77.

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