Clinical and 3-Dimensional Analyses of Nasal Forms After Secondary Correction of Cleft Lip-Nose Deformities Using Extended Spreader Cartilage Graft With a Cross-Lap Joint Technique

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Purpose: A surgical strategy for definitive cleft lip-nasal correction that stably provides symmetric and natural nasal forms has not been established to date. The purpose of this study was to describe our surgical techniques and 3-dimensional (3D) assessment results after the definitive correction of cleft lip-nose deformity using an extended spreader cartilage graft with a cross-lap joint technique to achieve a rigid strut for lower lateral cartilage repositioning to obtain a desirable nasal tip projection.

Patients and Methods: This study enrolled 14 patients with unilateral cleft lip (UCL) with or without cleft palate and 8 patients with bilateral cleft lip (BCL) with or without cleft palate who underwent definitive nose correction and were followed for 1 to 3 years. All patients were treated by open rhinoplasty, repositioning of the lower lateral cartilage, use of an extended spreader cartilage graft with a cross-lap joint technique for nasal tip support, and medial-upward advancement of nasolabial components with vestibular expansion by a free mucosal graft. For the BCL nose, pedicle flaps from rim skin were used for columella lengthening. Preoperative and postoperative nasal forms were 3-dimensionally analyzed by use of 3D images serially obtained in 12 patients.

Results: The postoperative nasal forms were satisfactorily improved in all patients, without any serious postoperative complications. Preoperative and postoperative 3D analyses showed a significantly projected nasal tip in the postoperative noses of patients in both the UCL group and the BCL group ($P < .01$ and $P < .05$, respectively) and a sharper nasal tip angle in the BCL group ($P < .05$). Lateral deviation of the nasal tip was significantly improved in the center of the face in patients in the UCL group ($P < .01$).

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Conclusions: The results of this study suggest that the extended spreader cartilage graft using the cross-lap joint graft technique is useful to provide a desirable projection of the nasal tip in the center of the face on definitive correction of both UCL and BCL nose deformities.
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Despite recent developments in cleft surgery, surgical modalities for the secondary correction of nasal deformities of patients with unilateral cleft lip (UCL) and bilateral cleft lip (BCL) remain controversial. Surgeons have attempted cleft lip-nose correction, and they are often frustrated with unsatisfactory results. A considerable number of surgical modalities for the definitive correction of cleft lip-nose deformity have been reported over the past half century. Historically, previous reports described external excisions[1,2]; rotational advancement[3,4]; incisional approaches to the tip[5,6]; repositioning of the lower lateral cartilage[7-12]; grafting procedures to the tip,[13-15] columella, and/or underlying maxillary base molding; external and internal Z-plasty to secure additional vestibular skin[16,17]; and routine rhinoplasty and septoplasty. Recent reports have mainly focused on the correction of the cartilage, producing a desirable nasal tip cartilage projection using bone and cartilage grafts.[18-24] However, a surgical strategy for definitive cleft lip-nasal correction that stably provides symmetric and natural nasal forms has not been established to date.

We have reported surgical strategies for cleft lip-nose correction that approached each anatomic and pathologic abnormality possibly causing the main deformities of both UCL and BCL noses.[25,26] Subsequently, we analyzed the postoperative nasal forms of patients who underwent secondary correction of cleft nose deformity following our surgical strategies by means of 3-dimensional (3D) analyses.[27,28] The results of 3D analyses indicated that our surgical strategies for secondary correction provided satisfactory results, producing a symmetric form of the nasal tip and nasal ala. However, when compared with the noses of healthy Japanese adults, the postoperative nasal forms tended to show "over-projection." Because the nasolabial angle in Japanese adults is smaller than that of white individuals,[29] excessive projection of the nasal tip leads to an undesirable short nose.

Therefore, on the basis of the aforementioned experiences, we started using an extended spreader cartilage graft with a cross-lap joint technique to support the nasal tip and lower half of the nasal dorsum in 2011. The extended spreader cartilage graft was originally described as a technique used in secondary rhinoplasty to reconstruct the roof of the middle vault.[30] The spreader graft currently represents a commonly used tool in primary rhinoplasty with multiple goals, including the prevention of middle vault collapse and internal valve dysfunction, esthetic re-creation of the nasal dorsum, and correction of nasal deviation.[31,32] In the correction of cleft lip-nose deformity, although several case reports in which the extended spreader graft technique had been used were found,[33-35] there was no well-described study with the objective assessment of postoperative nose forms.

When we applied an extended spreader graft in patients with clefts, it was difficult to harvest a large enough piece of cartilage from the nasal septum because the noses of Asians are not as high as those of white persons and over-resection of the nasal septum might cause a complication of postoperative warping of the nasal dorsum. Furthermore, in many patients with cleft nose deformity, correction of the underdeveloped nasal dorsum, as well as nasal tip correction, was needed. Therefore, we started using the unilateral spreader cartilage graft with the cross-lap joint technique. The cross-lap joint is often used in wooden handicrafts for joining 2 or 3 wooden parts without using fixing tools (Fig 1). The cross-lap joint technique was used to fix the grafted cartilage tightly in the center of the face against the tension of the overlying skin flap on the nasal tip. This is because tight skin may press the grafted cartilage at the nasal tip, resulting in a caudal shift and subsidence of the grafted material, leading to an undesirable nasal tip. Using the cross-lap joint technique, we expected to avoid over-projection of the nasal tip and, furthermore, to mold the nasal tip and nasal dorsum simultaneously, resulting in an adequate nasal profile. In this article, to assess the outcomes of our secondary correction of cleft lip-nose deformity using an extended spreader cartilage graft with the cross-lap joint technique, the preoperative and postoperative nasal forms were 3-dimensionally analyzed and compared.

Patients and Methods

Twenty-two patients with cleft lip with or without cleft palate underwent the definitive correction of cleft lip-nose deformity in the Department of Oral and Maxillofacial Surgery, Kagoshima University Hospital. There were 13 male and 9 female patients, and patient ages ranged from 16 to 30 years, with a mean age of 17.8 years. The timing of definitive nose correction was decided after the patients reached 16 years of age, with confirmation that their growth in terms of

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