Maxillary vestibular incision for surgically assisted rapid palatal expansion: Evidence for a conservative approach

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Aim: To evaluate the soft tissue changes in upper lip, vermilion, and alar bases after surgically assisted rapid palatal expansion (SARPE). A new flap design was proposed to obtain more esthetic results. Methods: Sixteen patients who had undergone SARPE for skeletal deformities were evaluated. None of the patients treated had any previous maxillary or nasal surgery, nor did they have any previous trauma to the midface. The soft tissue was clinically evaluated before and after surgery. Lip length and width were traced and measured on the radiograph, both preoperatively and postoperatively, by the same investigator. Preoperative and 6-month postoperative photographs were added. Results: The data suggested that the greater the stability in the soft tissue, particularly in the vermilion width and alar base, the more conservative the maxillary vestibular incision could be. Conclusion: A conservative anterior vestibular incision at 6 months resulted in better esthetics, influencing a smaller loss of vermilion and less widening of alar bases. Otherwise, a traditional incision associated with decreased lip length slightly increased with the modified incision. SARPE can be effectively performed with a more conservative vestibular incision to prevent excessive scarring and shortening of the lip to achieve predictable results. ORTHODONTICS (CHIC) 2012;13:168–175.

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Surgically assisted rapid palatal expansion (SARPE) is a widely used, effective, and stable procedure to correct severe maxillary transverse deficiencies. This technique is considered a common procedure in the correction of maxillary transversal deficiencies. In younger patients, conventional orthodontic rapid palatal expansion before closure of the midpalatal suture is reported to be successful.1–3 SARPE has become a widely used and acceptable means to expand the maxilla in adolescents and adults. The method takes advantage of bone formation at the maxillary edges of the midline, while an external force separates them. However, this technique does not work very well in skeletally mature individuals because the sutural closure and the completion of transverse growth could influence the final expansion of the maxilla.
In adults, the realization of rapid maxillary expansion could be complicated by the increasing rigidity of the bony structures with age, and to a lesser extent by the increasing degree of ossification in the median palatal suture, so that an additional surgical weakening of specific midfacial structures is required. The expansion is primarily composed of alveolar or dental tipping, with little or no basal skeletal movement. Therefore, SARPE is a widely accepted technique in patients older than 15 years with isolated considerable (> 5 mm) transverse maxillary deficiency.

Although a number of reports have been published on stability after SARPE, surprisingly little detailed information exists to document postsurgical changes with this procedure and to differentiate between dental and skeletal outcomes. The reason could be related to the use of only dental casts or to the application of a direct measurement of dental arch dimensions without the use of posteroanterior cephalograms. In this way, skeletal changes could be differentiated from tooth movement. Stability is often reported from the end of postexpansion orthodontic treatment, not from the point of maximum expansion. The changing of soft tissue is often influenced by the bone repositioning and the flap design. Maxillary expansion is an excellent means to provide space for all the teeth and improve esthetics by eliminating negative space. It is therefore the treatment of choice. Posterior crossbite correction is also achieved and may prevent further tooth abrasion and periodontal deterioration in the long term.

Esthetic changes depend not only on bony architecture, but also on alteration of the soft tissue. It has been suggested that soft tissue changes may be more affected by the type and position of the soft tissue incision and methods of closure than by the surgically induced hard tissue change. The traditional maxillary vestibular incision made from maxillary first molar to contralateral first molar can cause muscle detachment during stripping of the periosteum, which then shortens and retracts laterally and causes shortening and thinning of the upper lip with decreased visible vermilion. Additionally, maxillary expansion without suturing the alar bases invariably gives rise to a widening of the nasal base. A conservative maxillary vestibular incision for SARPE involves bilateral incisions from maxillary first molar to canine with a small midline vertical incision, thus maintaining intact portions of the upper lip mucosa and musculature.

The aim of this study was to evaluate soft tissue changes in the upper lip, vermilion, and alar bases of SARPE patients who received a traditional incision and those who received a conservative maxillary vestibular incision.
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**METHODS**

As part of an ongoing prospective study, the data from 16 patients undergoing SARPE for treatment of skeletal dental deformity at Loma Linda University Medical Center, Loma Linda, California, USA, between November 9, 2008, and March 6, 2010, were analyzed. All patients had posterior crossbites with natural dentition and were undergoing presurgical orthodontics. The same surgeon performed all surgeries in the exact same manner with the exception of the maxillary vestibular incision. The patients had no previous maxillary or nasal surgery and no previous trauma to the midface.

Standard lateral cephalometric radiographs were obtained with the patient in full rest position both preoperatively and at least 6 months postoperatively using the same radiography unit (Fig 1). Lip length and width were traced and measured on the radiograph both preoperatively and postoperatively by the same investigator using the following landmarks: A-point (A), subnasale (Sn), labial superiorus (Ls), stomion superioris (Ss), and the labial aspect of the maxillary incisor (L). The dimensional changes of the upper lip were measured using the following distances: A-Sn, superior thickness of lip; C-Ls, inferior thickness of the lip; and Sn-Ss, upper lip length (Fig 2).

Preoperative and 6-month postoperative photographs were taken with the subject’s head in a natural position (Fig 3). All patients were kept at a standard distance from the camera (45 inches) using a 50-mm macro lens. Additionally, the photographs were standardized to one another by enlarging or reducing the projection lens to match the pre- and postoperative intercanthal distance. Upper lip length was measured as the distance between subnasale and stomion. Upper lip vermilion width was measured as the distance between labial superioris to stomion superioris. Alar base width was measured as the distance from the lateral alar margin to lateral alar margin (Fig 4).

**Surgical procedure**

Under general anesthesia, a no. 15 blade was used to make an incision 5 mm apical to the mucogingival junction, extending from right first molar to the mesial aspect of the canine. A similar incision was then created on the mesial of the left first molar to the medial of the left canine (Fig 5). For those patients...
who received the traditional approach, one continuous incision was made from first molar to first molar. A periosteal elevator was then used to create a full-thickness mucoperiosteal flap, bilaterally exposing the infraorbital foramen. The piriform rim was dissected medially, and the zygomatic buttress region was dissected laterally. The periosteal elevator was then used to dissect the lateral floor of the nasal mucosa to free it from the maxilla. This was propagated using a modified Freer Periosteal Elevator (HMN Medical). Using a reciprocating saw, a LeFort I level osteotomy was made bilaterally from the zygomatic buttress region to the piriform rim. An oscillating saw and pterygoid chisel were used to separate the pterygoid plates. Using a safe-sided chisel, the lateral border of the piriform rim was also ostomized. The nasal septum was also cut. A 1-cm vertical incision was created using a no. 15 blade to expose the nasal spine. A spatula-type chisel was then used to create an osteotomy along the midline of the palate, beginning from the nasal spine to the midroot level of the anterior nasal spine all the way to the posterior portion of the maxillary suture. A Hyrax palatal device was activated, and bilateral expansion was noted. To close the incisions and resuspend the lateral nasalis muscle, 3-0 chromic sutures (Ethicon) were used (Fig 6).
RESULTS

The results of 9 patients with the traditional incision (5 men and 4 woman; age range, 22 to 49 years; mean age, 34 years) and 3 patients with the conservative incision (2 men and 1 woman; age range, 18 to 37 years; mean age, 28 years) are presented.

Cephalometric analysis

**Upper lip length (Sn-Ss).** The mean change in the upper lip length measured as the distance from Sn to Ss was \(-0.25 \pm 2.01\) mm in the traditional incision (range, 3 to \(-2\) mm) and \(0.5\) mm \(\pm 0.125\) in the modified incision.

**Superior upper lip thickness (A-Sn).** The mean change of lip thickness at the superior portion of the upper lip measured as the distance from A to Sn was \(0.375 \pm 1.23\) mm in the traditional incision and \(-1.0 \pm 1.0\) mm in the modified incision.

**Inferior upper lip thickness (C-Ls).** The mean change of lip thickness at the inferior portion of the upper lip measured as the distance from C to Ls was \(0.3125 \pm 0.98\) mm in the traditional incision and \(1.66 \pm 0.22\) mm in the modified incision (Table 1).

Photographic analysis

**Upper lip length (Sn-Ss).** The mean change in the upper lip length measured as the distance from subnasale to stomion superioris was \(-0.125 \pm 1.74\) mm in the traditional incision and \(0.5 \pm 0.125\) mm in the modified incision.

**Upper lip vermilion (Ls-SnSS).** The mean change in the upper lip length measured as the distance from labial superioris to stomion superioris was \(-0.375 \pm 0.21\) mm in the traditional incision and \(0.16 \pm 0.05\) mm in the modified incision.

**Alar base width (lateral alar margin to lateral alar margin).** The mean change in the alar base width measured as the distance from lateral alar margin to lateral alar margin was \(0.57 \pm 1.3\) mm in the traditional incision (range, \(+2\) to \(-2\) mm) and \(0 \pm 0\) mm in the conservative incision (Table 2).

Although maxillary expansion might be required for many patients, there are still no conclusive ways to identify the optimal equilibrium between extensive surgeries for adequate mobilization vs a conservative procedure with minimal complications.
DISCUSSION

SARPE is considered a useful and predictable method of treatment to increase the transverse dimension of the maxilla in skeletally mature individuals. The surgical technique for SARPE involving a midpalatal split was described in 1938; later, a Le Fort I type of osteotomy with a segmental split of the maxilla popularized the use of an osteotomy of the zygomatico-maxillary buttress as the major factor in overcoming resistance to maxillary expansion. Several modifications to the surgical approach have been recommended, but no quantitative guidelines exist about the minimum osteotomy required to facilitate maxillary expansion, and no general guidelines for esthetic flap design have been discussed. Ideally, the extent of surgery should depend on the areas of resistance with some individualization.

There is a lack of consensus among orthodontists and surgeons about the indications for SARPE. Although maxillary expansion might be required for many patients, there are still no conclusive ways to identify the optimal equilibrium between extensive surgeries for adequate mobilization vs a conservative procedure with minimal complications. Advances in imaging techniques have added another dimension to the evaluation of bone density and surgical manipulation. These can assist in achieving greater precision and help standardize surgical techniques and orthodontic treatment protocols.

The following indications for SARPE have been reported in the literature, all applying to a skeletally mature patient with a constricted maxillary arch:

- To increase maxillary arch perimeter and correct posterior crossbite when no additional surgical jaw movements are planned
- To widen the maxillary arch as a preliminary procedure, even if further orthognathic surgery is planned—this is to avoid increased risks, inaccuracy, and instability associated with segmental maxillary osteotomy
- To provide space for a crowded maxillary dentition when extractions are not indicated
- To widen maxillary hypoplasia associated with clefts of the palate
- To reduce wide black buccal corridors when smiling
- To overcome the resistance of the sutures when orthodontic maxillary expansion has failed

The traditional horizontal incision in the upper labial vestibule commonly used to gain access to the maxilla for SARPE with continuous running suture closure causes shortening of the lip with loss of vermilion and a decrease in lip thickness.

Predicting the final position and appearance of the soft tissues after maxillary surgery has proven to be difficult. For thin lips (12 to 17 mm), there was a good correlation between the magnitude of bony movement and the amount of soft tissue change. Despite this correlation, the final position of the soft tissue in maxillary surgeries could be affected more by the type and position of the soft tissue incision and methods of closure than by the hard tissue changes. In some studies, a tendency was detected toward a more posterior positioning of the upper lip with the SARPE. The use of a V-Y suture compensated for and helped prevent loss of labial support.

Because of the minimal amount of maxillary bone movement in the vertical direction, procedures of maxillary expansion lend themselves to comparative analyses of soft tissue alterations caused by the type of incision and suture used.
CONCLUSION

Orthognathic surgeries that involve the maxilla invariably give rise to important changes in soft tissue, especially in the upper lip and nose. The general trend is a thinning of the upper lip with widening of the alar base in all patients regardless of the vector of maxillary movement. Nevertheless, the data thus far in our study suggest greater stability in soft tissue, particularly in vermilion width and alar base with the conservative maxillary vestibular incision. Our initial data suggests the following:

- A conservative anterior vestibular incision at 6 months had less loss of vermilion and less widening of alar bases.
- A traditional incision was associated with a decreased lip length whereas the lip length increased slightly with the modified incision.
- SARPE can be effectively performed with a more conservative vestibular incision, prevent excessive scarring and shortening of the lip, and achieve predictable esthetic results.

Some authors stated that the surgical dilemma is to reconcile optimal therapeutic outcomes with a minimally invasive procedure.25–28 This study demonstrates a minimally invasive yet effective alternative approach for SARPE with decreased shortening of the upper lip, loss of vermilion, and widening of the alar base. It is possible to prevent excessive scarring and retraction and achieve predictable, superior esthetic results.

“Orthognathic surgeries that involve the maxilla invariably give rise to important changes in soft tissue, especially in the upper lip and nose.”
REFERENCES


