Surgically-assisted maxillary expansion

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Abstract
A combined surgical and orthodontic technique for management of transverse maxillary deficiencies in mature patients is described and discussed. Special references are made to the surgical release of several circummaxillary articulations to facilitate the use of a fixed expansion device, and to the authors’ addition of an osteotomy below the nasal spine, to ensure that the nasal septum remains independent of the maxillary segments. Indications for the use of this surgically-assisted maxillary expansion technique, and its advantages when compared with segmented surgical expansion, are also presented.

Key words: Orthodontics, orthognathic surgery, maxillary expansion, distraction-osteogenesis.

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Introduction
Rapid maxillary expansion was first described in 1860,1 when an expansion-screw was attached to the maxillary first premolars of a 14 year old girl with a constricted maxillary arch. The patient was directed to turn the screw twice daily for a period of two weeks. This led to the widening of her maxillary arch and the formation of a large diastema between her central incisors. Since then, much has been written about rapid maxillary expansion,2-10 and the procedure has become an accepted part of contemporary orthodontic practice. It is, however, of limited benefit in mature teenage and adult patients, since sutural closure at all the maxillary articulations is thought to increase the resistance of the maxillae to expansion.2-11 Techniques have therefore been developed to overcome these restrictions. These techniques involve the surgical release of the maxillae to facilitate the use of rapid maxillary expansion devices. Various combinations of lateral maxillary, pterygo-palatine-maxillary and midpalatal releasing osteotomies have been described.12-22 There has, however, been little discussion in the literature regarding the relative efficacy of each procedure. It is the purpose of this article, therefore, to describe and to discuss the surgically-assisted maxillary expansion technique (SAME) used by the authors over an eight-year period.

Indications for SAME
Surgically-assisted maxillary expansion can be considered as part of the overall treatment plan for a mature patient with a constricted maxillary arch for the following.

1) To widen the arch and to correct a posterior crossbite when no other surgical jaw movements are planned.

2) To widen the arch as a preliminary procedure, even if further orthognathic surgery is planned, either to avoid the increased risks associated with segmented total maxillary osteotomies;23 or if the extent of necessary expansion is greater than that which can reasonably be expected to be stable following segmented expansion (that is, greater than 8 mm). The inaccuracy associated with segmented maxillary osteotomies is also avoided.

3) To widen the arch and to provide space for alignment without the need for maxillary premolar extractions, if the space requirement could reasonably be gained as a result of maxillary expansion,10 and if other factors, such as the protrusion of the maxillary incisors on their underlying bone have been taken into account.

4) To widen the arch following maxillary collapse associated with a cleft palate.

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Technique of SAME

A rigid expansion appliance is usually cemented to the first premolars and first molars on each side, but it may also be attached only to the first molars (Fig. 1). This is especially useful if the paths for insertion of the bands on the first premolars and first molars are divergent. Care should be taken to keep the screw-device well clear of the palate, so that there is no interference during the expansion phase. The appliance is placed in the mouth a few days before surgery to allow the patient to accommodate to it. After the SAME procedure, there is often some temporary paraesthesia associated with the maxillary posterior teeth. It may therefore also be helpful to fit and cement molar bands in the lower arch before this surgical procedure is carried out, if the patient’s bite is to be used when seating those bands.

In the operating room, the patient is placed under general anaesthesia and an incision made in the depth of the maxillary vestibule from the region of the first molar on one side to the midline. The soft tissues are reflected subperiosteally from the lateral aspect of the maxilla, with dissection to expose the anterior floor of the nose and piriform aperture area, posteriorly to the pterygo-maxillary fissure (Fig. 2).

The level of the lateral maxillary osteotomy is measured to be at least 5 mm above the apices of the teeth. As the anterior portion of the osteotomy is being performed, a periosteal elevator is maintained in the piriform rim, lifting the nasal mucoperiosteum to protect it. The lateral wall osteotomy is extended posteriorly to the pterygo-maxillary fissure. This osteotomy cut is designed with a step, as for a complete maxillary osteotomy. It is the authors’ observation that, when a subsequent definitive maxillary osteotomy is performed, there may not be complete bony healing along the original bone incision. This might compromise any subsequent surgery, if a non-stepped osteotomy design were chosen.

Fig. 1.–Rapid maxillary expansion device with bands fitted only to the first molars. a, Before expansion. b, After 28 activating turns.

Fig. 2.–Operative view following anterior incision and dissection of the nasal floor, with the nasal spine still in place.

Fig. 3.–Operative view demonstrating the nasal spine being released with a fine straight osteotome.

Fig. 4.–Operative view following release of the nasal spine, which remains attached to the nasal septum.
On completion of the lateral maxillary osteotomy, a periosteal elevator is passed subperiosteally, posteriorly into the lateral wall of the nose. This is used to protect the nasal mucoperiosteum while a guarded osteotome is malletted posteriorly for approximately 30 mm, to section the lateral nasal wall, well-short of the greater palatine neurovascular bundle. A similar soft tissue incision is now made on the opposite side, and the identical dissection and osteotomies are performed.

The nasal spine and septum are now released with a guarded osteotome (Fig. 3), extending at least 30 mm posteriorly, having first performed an osteotomy below the nasal spine, leaving it attached to the septum and ensuring that the septum remains independent of the maxillary segments (Fig. 4). This nasal spine osteotomy is the authors’ modification to the surgical procedure described by Epker and Fish. After initial scoring with a bur, a midpalatal osteotomy is then accomplished by malletting an osteotome posteriorly, parallel to the palatal plane, into the intermaxillary suture and directed to the posterior nasal spine. These procedures ensure that separation of the entire midpalatal suture has occurred. One thus avoids both septal deviation and the inadvertent widening of the nasal spine.

Before the soft tissue incisions are closed, the expansion screw is turned eight to twelve times, so that the maxilla is expanded 2 to 3 mm. This amount of immediate expansion would normally cause blanching of the incisal gingival tissues. While pterygo-maxillary separation is seldom if ever required, it is important to ensure that the expansion is occurring bilaterally and symmetrically. Once that has been confirmed, the expansion device is wound back approximately four turns, until all gingival blanching has been relieved. This is very important if subsequent gingival dehiscence on the mesial surfaces of the central incisors is to be avoided. The wounds are closed as for a total maxillary osteotomy, taking care to re-approximate the musculature with deep periosteal sutures. An alar cinch suture will usually prevent alar base flaring which might otherwise complicate the procedure.

It should be noted that the surgical removal of third molar teeth can be readily accomplished at the same time as SAME. The combined morbidity of the two procedures is little more than that which would be expected with the surgical removal of third molars, alone.

Following the SAME procedure, the appliance is activated by the patient, one quarter turn each day, until the desired expansion has been achieved (Fig. 5 a-d). It is usually expanded to its maximum width, because it is easier to allow the maxillary posterior segments to settle back, if necessary, into ideal transverse relationships with their lower opponents, than to somehow re-expand the arch later, if it is subsequently recognized that there has been an insufficient gain in width. Within the week following the last activating-turn, orthodontic brackets are placed on the labial surfaces of at least the eight upper anterior teeth. These brackets are then joined with a light aligning wire to control not only the tendency for mesial tipping of the incisors as they move together again, but also the upper anterior archform. Only when that upper archform has been set and the spaces closed (usually three to six months following the SAME procedure), should the expansion device be removed. The remaining lower fixed appliances can of course be fitted at any time during this postoperative period.

When the appliance is eventually removed, it is important that steps are taken to maintain the gain in width across the molars by immediately replacing bands on the first molars and inserting an expanded continuous archwire. A rigid trans-palatal arch may also be useful at this time. This is true, regardless of the amount of expansion achieved, the amount of planned over-correction, or even the duration of the holding period with the expansion appliance still in place. The occlusion will still be poor in most cases (Fig. 5 e, f), and the gain in width does need to be protected, until a well-supported occlusion has been provided – either at the completion of conventional orthodontic treatment or following another orthognathic procedure (Fig. 5 g, h).

Discussion

The described technique has been used by the authors, in both hospital and private practice, for more than eight years. During this period over forty patients have been managed. Because of its limited nature, the procedure has been associated with minimal morbidity. Excessive intra-operative and postoperative haemorrhage can be avoided by limiting the sectioning of the lateral wall of nose to approximately 30 mm, and by taking care with nasal dissection to avoid tearing. Postoperative haemorrhage, if it does occur, can be well controlled with the use of Epistats.

By maintaining the horizontal osteotomy at least 5 mm above the tooth apices, the risk of disturbance to the vitality of the teeth is minimized. If appropriate care is also taken with the vertical osteotomy between the incisors, root damage is unlikely to occur. In any case, the final division between the roots is completed with an osteotome through the midline suture, thus protecting the bone coverage of the central incisor roots.

Postoperative pain is seldom severe and is usually controlled with oral analgesics. Patients would then normally take an analgesic one hour prior to each subsequent activation, thus avoiding any discomfort which might be associated with the expansion of the bones and soft tissues. Patient acceptance of the SAME procedure is high, particularly when it is combined with the surgical removal of third molars.

Fig. 5.—Frontal and occlusal views of a patient with an asymmetric Class III malocclusion and associated maxillary constriction. a, b, Before treatment. c, d, After 28 activating turns (7 mm). e, f, Following placement of fixed labial appliances and removal of expansion device. g, h, Following definitive maxillary and mandibular osteotomies and completion of active orthodontic treatment.
In that case, the patient does not feel that an ‘additional’ operation is being undertaken.

The authors have found this procedure provides arch-width stability in both the medium and long term. If the expanded maxillary arch is eventually supported by the mandibular arch and its dentition, the gain in arch-width is likely to be maintained. Difficulties can arise, however, when the occlusion is left unsupported prior to further definitive orthognathic repositioning of the jaws. In these cases, transverse retention does need to be maintained until the occlusion has been properly stabilized.

The SAME procedure is, in fact, an example of distraction-osteogenesis, a concept which has now found popularity in both the orthopaedic and maxillofacial literatures. Equally, it can be considered to be a type of controlled soft-tissue expansion, a new vogue in plastic surgery practice. The palatal soft tissues are slowly stretched, thus preventing dehiscence and allowing for expansion with less tension.

In summary, the SAME technique has the following advantages when compared with segmented surgical expansion.

1) The maxillary arch can be expanded orthopaedically, either unilaterally or bilaterally, in a mature patient with minimal morbidity.

2) In orthognathic cases, this technique allows the orthodontist to create an ideal maxillary arch-form which, in turn, simplifies the subsequent orthognathic surgery, even if the maxilla still needs to be moved in either or both the vertical or the horizontal planes.

3) The technique minimizes the risks of avascular necrosis and difficulties in positioning and stabilizing segments, both of which may be associated with segmented maxillary osteotomies.

The SAME technique may, therefore, play a most useful part in the overall management of selected patients with a variety of malocclusions and dentofacial deformities.

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References


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