

Surgically Assisted Maxillary Expansion



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KEYWORDS

• Transverse maxillomandibular discrepancy • Stability • Surgically assisted maxillary expansion • SAME

KEY POINTS

- The transverse dimension of the maxillomandibular complex must be evaluated, diagnosed, and addressed to achieve stability after orthognathic correction.
- Orthopedic maxillary expansion (nonsurgical) is effective and stable in the young population before sutural closure and is not effective or stable in patients after sutural closure in the maxillofacial complex. Treatment with orthopedic expansion in this group leads to uncontrolled relapse and periodontal and occlusal complications of the teeth after the removal of orthodontic appliances.
- To achieve the desired expansion and stability, transverse maxillary expansion should be accomplished by sutural adjustments in the craniofacial complex, not by alveolar bending and dental tipping. The SAME (surgically assisted maxillary expansion) procedure is a combination of distraction osteogenesis and controlled soft tissue expansion.
- After the surgical procedure, the maxilla should remain stationary for at least 5 days before initiation of expansion at a rate of 0.5 mm/d.
- Surgical transverse changes are unstable for a longer period than are most other surgical or orthodontic movements. It takes approximately 6 months to achieve bony continuity in the midpalatal osteotomy site. Therefore, some form of skeletal retention is recommended for at least 6 to 12 months after expansion.

Introduction: nature of the problem

Complete and accurate evaluation of a patient with a dentofacial deformity must include assessment of the transverse dimension. Few practitioners adequately evaluate the transverse dimension, often resulting in undiagnosed transverse maxillomandibular discrepancy. When a transverse maxillomandibular discrepancy exists, adult patients have traditionally been treated with orthodontic expansion or a segmental maxillary osteotomy, frequently leading to transverse maxillary instability and relapse after orthodontic appliance removal.

Orthopedic or rapid maxillary expansion (ORME) is also a technique used to treat transverse maxillomandibular discrepancy. If used in the correct patient population, this technique is predictable and stable for the correction of transverse maxillomandibular discrepancy. It is of limited benefit in mature teenage and adult patients, because the maxillary articulations become increasingly resistant to expansion with aging. Techniques of surgically assisted maxillary expansion (SAME) have been developed to overcome this

age limitation. The SAME procedure is a combination of distraction osteogenesis and controlled soft tissue expansion. Discussion of SAME is often confusing because various combinations of maxillary, pterygopalatine lateral nasal, septal, and palatine osteotomies have been used, based on the surgeon's theory of where resistance to expansion is located. The purpose of this article is to describe the clinical and radiographic evaluation of the transverse dimension in patients with dentofacial deformity and to present the indications for SAME and an anatomically based SAME technique.

Surgical technique

Preoperative planning

Accurate diagnosis and treatment of transverse maxillary deficiency are essential to the long-term stability after correction of any dentofacial deformity that includes a transverse discrepancy. However, diagnosis of transverse maxillary deficiency may be difficult, because minimal facial soft tissue changes are associated with isolated transverse maxillary hypoplasia. In contrast, isolated anteroposterior or vertical skeletal deformities are easier to diagnose, because they often have obvious associated facial soft tissue findings. Consequently, the transverse deformity is often not diagnosed when sagittal and vertical deformities exist concomitantly. Therefore, it is not surprising that clinical inspection for transverse maxillary deficiency has been shown to be of poor diagnostic value. Complete diagnosis of this deformity must include both clinical and radiographic evaluation.

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Clinical evaluation

The existence and extent of a transverse discrepancy must be determined and the skeletal and dental components of the deformity must be differentiated before contemplating surgery (Box 1, Fig. 1).

Radiographic evaluation

A standard posteroanterior (PA) cephalogram is the radiograph of choice for identification and evaluation of a transverse discrepancy. Ricketts developed the Rocky Mountain analysis and established relative norms using specific radiographic landmarks and measurements to analyze transverse discrepancies between the maxilla and mandible (Box 2, Fig. 2).

Using these landmarks, it is possible to determine the effective maxillary width, effective mandibular width, and frontolateral facial lines. The effective maxillary width is the width of the maxilla between the points JL (jugale left) and JR (jugale right). The effective mandibular width is the width of the mandible between AG and GA. The frontolateral facial lines are the lateral lines constructed from OR (orbitale right) and OL (orbitale left) to the points AG and GA, respectively.

Using these cephalometric landmarks, it is possible to determine the maxillomandibular width differential and the maxillomandibular transverse differential index for quantification of the transverse maxillary discrepancy (Fig. 3). The maxillomandibular width differential is the distance (in millimeters) measured from the frontolateral facial line to JL and JR, respectively, along a line from the frontolateral facial lines through JR and JL. This measurement is calculated independently for each side and compared with a normal value of 10 ± 1.5 mm. If this value is greater than 10 mm, a transverse discrepancy between the maxilla and mandible exists. The values greater than 10 mm on each side are summed to quantify the total transverse deficiency. This technique is

useful in determining the total discrepancy and showing whether there is a greater deficiency or excess on 1 side or the other. However, this differential does not elucidate in which jaw the discrepancy exists and may be misinterpreted when mandibular asymmetry is present. The maxillomandibular transverse differential index is the age-specific expected maxillomandibular difference minus the actual measured maxillomandibular difference. The expected maxillomandibular difference is the age-appropriate expected AG-GA distance minus the age-appropriate expected JR-JL distance. The actual maxillomandibular difference is the actual AG-GA measurement minus the actual JR-JL measurement. In an adult patient, a maxillomandibular transverse differential index greater than 5 mm suggests a need for surgical expansion. As well as quantifying the total discrepancy, this method allows for the identification of which jaw is deficient or excessive, because actual values can be compared with normal values. Normal values have been suggested only for Caucasian, and these values should not be considered normal values for other races.

Treatment of transverse maxillomandibular discrepancy

SAME combines an orthopedic appliance and osteotomies to achieve maxillary skeletal expansion in 1 to 2 weeks (Box 3). The technique chosen to correct the transverse discrepancy is dependent on many factors, but most important is the skeletal maturity of the patient (Box 4). Additional factors include the magnitude of the transverse discrepancy and whether gingival dehiscence or bony fenestration is already present on the maxillary canine and bicuspid teeth. Generally, patients in the primary dentition and the mixed dentition stage are treated by ORME. Transverse maxillary growth ceases and the maxillofacial sutures close at skeletal age 14 to 15 years in females and 15 to 16 years in males. Adults are best treated by SAME or segmental Le Fort osteotomy.

After sutural closure, ORME is unsuccessful, because the expansion is composed primarily of alveolar or dental tipping, with little or no skeletal expansion. This situation can lead to many problems in adults, including an inability to activate the appliance, pain on activation, pressure necrosis of the palatal tissue under the appliance, tipping and extrusion of the maxillary teeth, bending of the alveolar bone, uncontrolled relapse after orthodontic appliance removal, and periodontal complications. These periodontal complications result from the tipping of the maxillary teeth out through the buccal cortical bone, resulting in cortical thinning, dehiscence, or fenestration of the maxillary teeth. If gingival inflammation is present, the patient is predisposed to gingival recession and dental instability (Fig. 4). In contrast, if the transverse maxillary deficiency is less than 5 mm of the total maxillomandibular discrepancy, sufficient buccal bone is generally present to allow for some dental tipping. In this case, ORME may be considered if there are no periodontal defects or gingival recession already present in the posterior maxillary quadrants.

Preparation and patient positioning

Before the procedure, an expansion device must be placed. The best results are achieved when one of the several variations of the jackscrew appliance is used. To achieve expansion, a palatally positioned jackscrew is placed within a framework

Box 1. Clinical indicators of transverse maxillary deficiency

1. Facial soft tissue changes including paranasal hollowing, a narrowed alar base, and deepening of the nasolabial folds
2. Negative space (distance between the corner of the mouth and the buccal surfaces of the posterior maxillary teeth during full smile)
3. Unilateral or bilateral posterior crossbite (a distinction must be made between dental and skeletal crossbite)
4. Crowded, rotated, and palatally or buccally displaced teeth
5. Narrow and tapering maxillary arch form, described as hourglass shaped
6. High, narrow palatal arch
7. Associated skeletal deformities include maxillary vertical and anteroposterior hypoplasia and zygomatic hypoplasia (as a result of growth issues)
8. Other associated dentofacial deformities include vertical maxillary excess, mandibular prognathism or mandibular sagittal deficiency, apertognathia, and repaired cleft palate

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