

THREE SEGMENT SURGICALLY ASSISTED RAPID MAXILLARY EXPANSION (SARME): TECHNICAL NOTE

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ABSTRACT

Surgically Assisted Rapid Maxillary Expansion (SARME) proved to be a reliable modality in orthodontic therapy for skeletally mature nongrowing adolescents, and adult patients to allow maxillary expansion. While conducting a clinical trial to compare the conventional 2-segment SARME technique with a 3-segment SARME technique, where the interdental osteotomies are placed bilaterally between canines and lateral incisors, we faced an obstacle. The right and left interdental osteotomies, between laterals and canines, tend to propagate and meet at the hard palate, segmenting the pre-maxilla from the rest of the maxillary bone, but not segmenting the nasal floor completely on the posterior aspect. Therefore, completing the osteotomy through the hard palate is necessary to assure an adequate expansion over the molar region. This was solved by a simple step included in the surgical sequencing described in this technical note.

INTRODUCTION

Entire and precise evaluation of patients with dentofacial deformity must include assessment of the transverse dimension. There are many clinical signs of maxillary transverse deficiency including unilateral or bilateral crossbite, crowded teeth, excessive display of buccal corridors when smiling, a narrow maxillary arch form, and a high and narrow palatal arch. Treatment with orthopedic or rapid maxillary expansion is effective in the young population, but is not stable in older patients, after sutural closure. Orthopedic expansion in this group of individuals leads to uncontrolled relapse, with potential periodontal and occlusal complications after removal of orthodontic appliances.¹

SARME proved to be a reliable modality in orthodontic therapy for skeletally mature nongrowing adolescents, and adult patients to allow maxillary expansion. It combines distraction osteogenesis of the maxilla in a transverse plane with controlled soft tissue expansion.² SARME provides transverse expansion of the dental arch and sufficient space for the tongue position, and future tooth arch harmonization. Even though SARME is an

established procedure to treat maxillary transverse deficiency in non-growing patients, there still is debate regarding the best surgical approach, i.e., the number and location of osteotomies, the type of appliance, the time to begin activation, and the necessity of overcorrection.^{3,4}

The conventional SARME technique involves segmenting the maxilla in 2 halves, between central incisors. Landes et al.⁵ described a 3-segment osteotomy, usually applied in cleft lip and palate patients, but performed in noncleft patients. The authors showed advantages, and also speculated that 3-segment SARME generates higher callus formation, and therefore it would more effectively prevent relapse.

While conducting a clinical trial to compare the conventional 2-segment SARME technique with a 3-segment SARME technique, where the interdental osteotomies are placed bilaterally between canines and lateral incisors, we faced an obstacle. The right and left interdental osteotomies, between laterals and canines, tend to propagate and meet at the hard palate, segmenting the pre-maxilla from the rest of the maxillary bone, but not segmenting the nasal floor completely on the posterior aspect. The study enrolled a total of 21 patients after approval by the local Institutional Review Board (protocol # 2.138.775), and registration at the ClinicalTrials.gov.

OPERATIVE TECHNIQUE

Surgical procedure is carried out utilizing a linear incision extending from right to left first premolars. Le Fort I osteotomy is performed superior to the anterior nasal spine, preserving this structure, either with saw, bur, or a piezo device, and is completed with osteotomes. Interdental osteotomies are performed between lateral incisors and canines with a thin and sharp osteotome approximately 5 mm to the alveolar from

buccal to palatal aspect from buccal to palatal aspect, until crest. Above the dental apices the osteotomies are performed with a 701 bur until the nasal floor.

After all osteotomies are accomplished, and to assure that the palate is also segmented, a sharp osteotome is positioned directly over the palatal mucosa without incision (**Figure 1**), and used to open the posterior aspect of the hard palate that may remain sound after the pre-maxilla is segmented. After completing the procedure, the hyrax is activated 3mm, mobility of the segments is verified, and the incision is sutured. A 5-day latency period is respected before patients initiate activation, both for initial callus formation, and for mucosal healing.



Figure 1: Osteotome positioned directly over the palatal mucosa without incision to assure that the palate is segmented.

DISCUSSION

After performing the 3-segment SARME we noted that, in some patients, the right and left interdental cut between laterals and canines may propagate and meet at

the hard palate, segmenting the pre-maxilla from the rest of the maxillary bone (Figures 2A-C). Therefore, completing the osteotomy through the hard palate is necessary to assure an adequate expansion over the molar region. This problem is not encountered in the conventional technique, since the midline cut propagates uniformly through the palate. However, this issue has not been mentioned in previous articles that evaluated the 3-segment SARME technique.^{5,6,7}

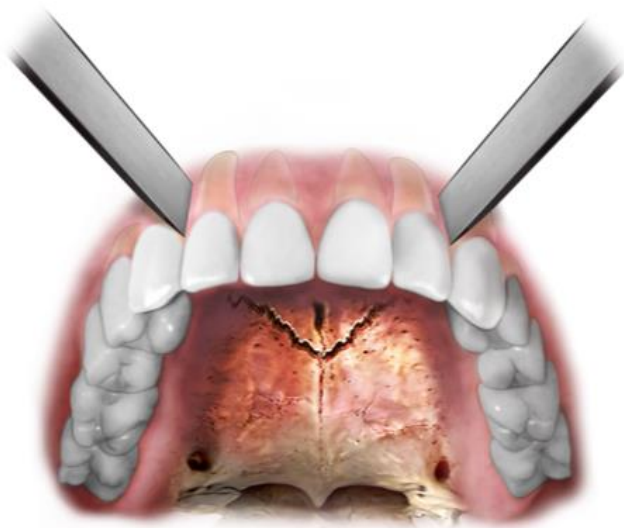


Figure 2A: Osteotomies between canines and lateral incisors (3-segment SARME), segmenting the pre-maxilla from the rest of the maxillary bone.

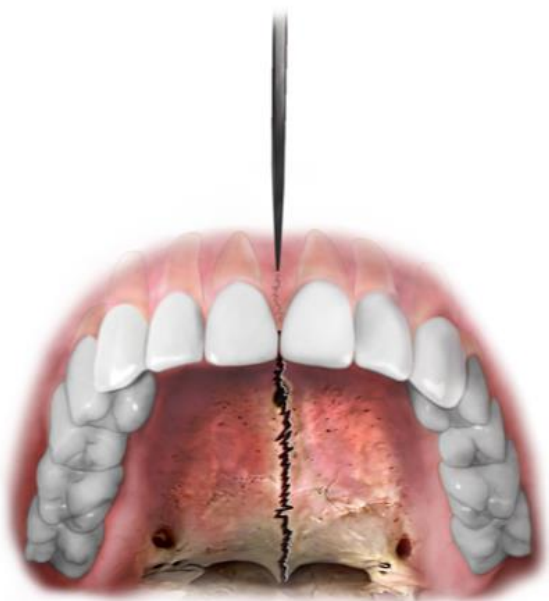


Figure 2B: Conventional technique (2-segment SARME).



Figure 2C: Axial CT image showing the cuts between laterals and canines meeting at the hard palate segmenting the pre-maxilla, and the posterior portion of the hard palate osteotomized by the described technique.

One possible alternative to solve these potential problems involves a more extensive procedure as described by Habersacket. al.⁸ The authors performed the segmentation of the nasal floor under direct visualization, after accomplishing complete maxillary downfracture. Another possibility to assure that the palate will be fully osteotomized is to make a palatal incision and cut the hard palate using a saw, or any other cutting device, as described in conventional SARME by Lee.⁹

The concern of not segmenting the whole palate might be of less significance on patients with vertical maxillary excess. This happens because those patients have more space between the dental apex and nasal floor, making it possible to correct the osteotome angulation above the apex, and direct the osteotomy toward the posterior aspect of the palate. This prevents the bilateral interdental osteotomies to meet before the palate is divided.

The potential advantages of the 3-piece SARME are:

- 1) lower aesthetic compromise, since the space created by the expansion is divided into right and left interproximal spaces between laterals and canines, instead of being concentrated on a disfiguring midline diastema;
- 2) lower midline dental papilla compromise;
- 3) preservation of the nasopalatine bundle;
- 4) possibility of performing, conservatively, asymmetric expansions of the maxilla.⁵

There also is the potential disadvantage of generating an oronasal fistula on the palate. This should be a rare situation, because the mucosa heals during the 5-day latency period between surgery and distraction activation. If a fistula does develop, it can be addressed by a von Langenbeck procedure after distraction is completed and stabilization is achieved.

When performing the 3-segment SARME, one should consider that, the described technical note is an effective and safe way to complete the osteotomy along the hard palate, allowing the maxilla to expand adequately on the molar region, ensuring more a stable and symmetric expansion of the maxilla.

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