Rapid Palatal Expansion In Adults

With and Without Surgery

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A cemented palatal expansion appliance with a bite plane is used successfully in adults up to 43 years of age, augmented with lateral maxillary osteotomy in the older ages range.

KEY WORDS: • OSTEOTOMY • PALATAL EXPANSION • SURGERY •

Dentists agree that the maxillary arch must be wider than the mandibular arch in a normal, stable occlusion. Thus, orthodontic correction to produce a stable, functional and TMJ-biocompatible occlusion sometimes involves true maxillary palatal expansion. When the orthodontist attempts to correct crossbites with elastics, the movement is often limited to buccal or labial flaring of teeth. In posterior teeth, flaring can cause chronic balancing interferences because the lingual cusps hang down and become the first to strike the mandibular teeth. In anterior teeth, flaring can reduce or eliminate anterior guidance.

Therefore, the orthodontist must be prepared to widen the maxilla where maxillary width deficiency is present in patients of any age. In the past, nonsurgical rapid palatal expansion has been, for the most part, limited to growing patients. Generally, it has been widely believed that females 16 or older and males 19 or older with maxillary width deficiency require either a surgical palatal expansion or must be compromised with buccal or labial flaring.

Even in growing patients, Rapid Palatal Expansion (RPE) has one main drawback. The procedure tends to open bites and cause an undesired vertical component with vertical hyperdivergence, especially those with short posterior facial height or a palatal plane tipped down in back as viewed cephalometrically.

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This paper demonstrates a conservative approach to maxillary expansion, using a bite-plane rapid palatal expansion device with and without minimal surgical augmentation. The surgical procedure does not involve a midpalatal cut, and can usually be performed on an outpatient basis in 40 to 60 minutes of operative time. Risk of serious surgical trauma is low, and cost is minimal as well.

The vertical restraint of the bite plane expansion device is also discussed.

— Literature Review —

One of the foremost proponents of the concept of rapid palatal expansion is HAAS (1961, 1965, 1970, 1973). BIEDERMAN (1973) expanded on Haas's ideas, using a tooth-borne appliance for maxillary expansion in conjunction with the correction of Class III problems. WERTZ AND DRESKIN (1977) show palatal expansion by different practitioners using different types of appliances. INOUE ET AL. (1970) studied rapid palatal expansion radiographically, including a report of successful expansion in a 50 year old.

MCCRACKEN (1969 AND 1970) show RPE as an integral part of orthodontic therapy, and BROADWAY (1967) demonstrated rapid palatal expansion in cleft palate.

WERTZ (1967) confirmed the advantage of RPE in improving nasal air flow in patients with stenosis of the nasal airway. He reports the greatest benefit where the stenosis is primarily in the anterior-inferior region, while those patients with stenosis in the posterior-superior portion of the nasal airway did not benefit from palatal expansion. TIMMS (1973) also confirmed the benefits of RPE for improvement of the nasal airway, stating "Of 200 cases, slightly over three quarters reported a definite improvement which was generally maintained and which in turn conferred additional benefits in general health in certain cases."

HAAS (1980) evaluated the stability of treatment that included rapid palatal expansion. He demonstrated "totally stable 4 and 5mm intercanine expansions in the lower arch many years out of retention. . . . and upper buccal teeth expanded 9 to 12mm with the expansion remaining absolutely stable."

Haas further stresses the necessity for acrylic buttons to apply pressure to the palate vaults, noting — "The heavy forces delivered to the palatal vault by the acrylic buttons of the appliance tend to compress the palatine arteries. This in turn stimulates the connective tissue surrounding these vessels to differentiate into osteoclasts to remove underlying bone and thus protect the arteries from injury. In so doing the vault is hollowed out and a true apical base expansion is induced . . . "

Rapid palatal expansion has not been without concern for supporting tissues. TIMMS AND MOSS (1971) found histologically that "in all these cases of rapid expansion there was damage to the root surface. This was not directly buccally but on the mesiobuccal and distobuccal aspect of the roots. Two years after rapid expansion evidence of recent root resorption and repair were still present. Marked changes were seen in the pulp, where secondary dentin was laid down on those aspects of the pulp nearest the trifurcation, and pulp stones were present in several cases." They used a Haas-type appliance with a split acrylic base.

BARBER AND SIMS (1981), using a fully tooth-borne appliance and electron microscope examination, found cementum and dentin resorption followed by remineralization. They state, "All anchor premolars exhibited root resorption, which was mostly confined to the buccal surface." They add further, "Active resorption was the dominant process in anchor premolars extracted almost imme-

diately after rapid expansion. Subsequently, repair became the predominant process, but continuing resorption was apparent even after 9 months of retention. Repair of root defects occurred by the deposition of cellular cementum which revealed little evidence of principal periodontal fiber reattachment within the advancing mineral front."

Even though Haas and others have described instances of rapid palatal expansion of the maxilla without surgery, for the most part reported maxillary expansion in adult patients has involved a surgical procedure.

EPKER AND WOLFORD (1980) state, "In patients over the age of 16 years, attempted orthopedic rapid maxillary expansion is frequently associated with significant difficulties. This is usually the result of fusion of the various craniofacial sutures, which results in a lack of suture opening on expansion. Inability to activate the expansion appliance and expand the maxilla is not uncommon. Tipping of the teeth, bending of the alveolar bone, and movement of the teeth through the buccal cortical plates are common consequences of orthopedic rapid maxillary expansion in adults.

Overcorrection to compensate for these undesirable changes is frequently frustrated by unpredictable and uncontrolled relapse after the orthopedic expansion appliance is removed. Subsequent relapse, even with prolonged retention, usually occurs. In addition treatment of true unilateral transverse maxillary deficiency in adults is not feasible via conventional orthopedic palatal expansion techniques, because a physiologic centric occlusion cannot be maintained. In such instances the expansion of the maxilla occurs bilaterally and masticatory function worsens."

Epker and Wolford further describe unilateral expansion with external and palatal osteotomies followed after suturing by rapid palatal expansion with an all tooth-borne appliance. Bilateral maxillary expansion is accomplished by essentially a LeForte I osteotomy, plus a midline cut, followed by RPE.

Some surgeons carry out a similar procedure with a LeForte I three-piece maxillary osteotomy procedure without the orthodontic palatal expansion device.

LINES (1975) states, "After realizing that the zygomatic buttress was the cause of most of the resistance to maxillary expansion in adults and recognizing the fact that the midline graft is not essential for the long-term stability of a surgical result, the conclusion was drawn that rapid maxillary expansion in adults was possible with the use of a corticotomy as an adjunct to mechanotherapy." He advocates a midline cut which separates the palatal shelves from each other and from the nasal septum and vomer articulations. This was followed by RPE.

KENNEDY ET AL. (1976) stress in their findings that " . . . true movement of the basal bone of the maxilla by rapid palatal expansion may be accomplished by reducing the resistance to lateral movement by osteotomies through the zygomatic buttress, nasomaxillary and pterygomaxillary areas."

LEHMAN, HAAS AND HAAS (1984) state, "Osteotomy of the zygomaticomaxillary buttress in combination with a rapid palatal expansion appliance is a dependable technique for the treatment of horizontal maxillary deficiency in adults. This procedure has been used in 18 patients with excellent expansion in 17. In one patient, expansion was discontinued prior to overcorrection because of pressure necrosis on the palate related to the appliance (Fig. 1). This was the only complication. The procedure is indicated mainly in those patients with a horizontal deficiency who do not require subsequent

Fig. 1 Palatal pressure necrosis that required premature removal of an expansion appliance in an adult.

surgery, but for some patients it may be the preliminary procedure."

Their surgical approach is osteotomies to the pterygomaxillary buttress and the anterior portion of the lateral nasal wall. They state, ". . . a horizontal osteotomy is made through the lateral wall of the maxilla, approximately 4 to 5mm above the apices of the teeth from the inferior lateral aspect of the maxillary tuberosity and the pterygoid plate." They do not believe that sectioning of the pterygomaxillary suture is usually required, but do a midpalatal osteotomy in patients who have ossification in that suture. They add, "In the patient with a true unilateral crossbite, only a unilateral maxillary osteotomy is required." Following the osteotomies, the expansion screw is activated two one-quarter turns, then twice daily until expansion is complete. The appliance is then maintained for 3 to 4 additional months.

GLASSMAN ET AL. (1984) report using . . . "only lateral maxillary corticotomies, and a maxillary Hyrax split palate appliance. In all 16 cases attempted, separation of the midpalatal suture was confirmed by occlusal radiographs and a diastema between the maxillary central incisors." They did not use midpalatal or pterygomaxillary osteotomies. Glassman performs these cuts as an office procedure. Upon completion of the osteotomies, he opens the appliance 4 quarter-turns. He adds, "On the third postoperative day, the patient is instructed to activate one quarter-turn in the morning and one in the evening, until adequate expansion has been achieved." He maintains the appliance for 12 weeks.

Glassman reports one postoperative sinus infection. The other complication is reported as follows — "In the one case of extrusion of the teeth cemented to the Hyrax appliance, removal of the buccal

aspect of the cemented Hyrax band allowed intrusion without loss of palatal expansion."

KRAUT (1984) reports operating on 25 patients for rapid maxillary expansion. He states, "Osteotomy of the lateral wall of the maxilla combined with pterygomaxillary dysjunction and midpalatal suture separation allowed for successful rapid maxillary expansion in 23 patients. The two patients who did not respond to treatment were found to have unusually thick midpalatal sutures, which were successfully expanded after the midpalatal sutures were osteotomized."

Kraut used cast appliances described by BRUDVIK AND NELSON (1981) and acrylic appliances. These appliances apparently used full coverage of the teeth with relief in the gingival area. The acrylic designs sometimes include cuspids, using a 10mm expansion screw and a hinge to permit selective expansion. Patients turn the screw 0.5mm in the morning and at night and are retained for 3 months.

Bite planes have been used for many years in orthodontics. The basic idea has been to open or unlock the cusp-fossa interdigitation and to relieve deep bites. According to JOHNSTON (1984), LAGAR (1967) introduced the idea that the intercuspation of the arches holds the jaw relationships and " . . . under normal conditions a change in the intermaxillary jaw relation will not influence the occlusion to the same extent because during function the arches are locked together by intercuspation."

In cases of malocclusion, the same effect that adds stability (intercuspation) can also prevent correction. Lagar states, "In a case where distal occlusion and maxillary overjet have developed at an early age, the malocclusion may be stabilized by an abnormal intercuspal locking and a pressure of the lower lip behind the upper incisors, even in the event of a continuous forward growth of the mandible in relation to the maxilla." He adds, "By eliminating the intercuspal locking — for example by means of a bite-raising plate — this course may be normalized. The lower arch may then be enabled to move forward with the mandibular base, so that the distal occlusion is corrected by the normal growth of the face."

Lagar calls this process "growth adaptation." This principle has been the basis for much of the development of functional appliances.

The implications are quite clear. Cusp-fossa interdigitation or intercuspation adds to the stability of occlusal relationships, both normal and abnormal. Might this interlocking also apply to width or mediolateral problems? Could it be that intercuspal locking interferes with palatal expansion? Biting pressure has been estimated by most sources to be somewhere between 250 and 350 pounds per square inch.

If this occlusal force could retard rapid palatal expansion through intercuspal locking, it seems reasonable to expect that unlocking or unloading this force by adding a bite plane to the rapid palatal expansion procedure could —

- free up the facial skeleton to expand regardless of sutural rigidity, and
- make nonsurgical expansion feasible in patients previously thought to require a surgical adjunctive procedure, and
- obviate some of the root resorption previously noted, and
- prevent some of the TMJ microtrauma associated with expansion and stabilization.

SUBTELNY (1980) wrote "Today in many instances where opening the midpalatal suture is indicated, an occlusal bite block

will frequently be used in conjunction with and as part of the rapid expansion appliance." He adds, "Several advantages seem to accrue from the conjunctive use of occlusal bite blocks. With a better grasp and overlay of the crowns there might be a reduction in the molar tipping action that has been previously noted. Perhaps this results from a greater facility to direct forces onto the nasomaxillary complex via the root structure itself.

"Furthermore, the occlusal bite block is deemed to be almost necessary when adverse anatomic relationships such as excessive vertical dimension of the face are an important consideration. Reference is particularly made to those cases in which facial growth, notably lower facial growth, is predominantly in a downward direction, indicating a possible openbite tendency . . . " Adding a 3-5mm bite plane to the RPE appliance could add significant orthopedic restraint to further vertical increase in some hyperdivergent patients.

Finally, SPOLYAR (1984) recently described a full coverage bonded rapid maxillary expansion appliance. In four case reports, he shows the use of this appliance " . . . in routine correction of posterior crossbite; in simultaneous correction of anterior crossbite, especially useful in cleft palate treatment; in combination with maxillary protraction; and in pre-expansion osteotomy cases."

Spolyar echoes some of Lagar's thoughts, stating that the bite plane appliance permits, "vertical clearing" of the anterior occlusion for simultaneous reduction of anterior crossbite and/or protraction of the maxillary complex." He adds, "Another advantage of indirectly fabricated and bonded RME appliances is the ease with which they are used by the surgeon in osteotomy expansion cases to test resistance to expansion and the adequacy of the surgical procedure while in the operating room.

— Technique Development —

As a former patient, and student of Dr. Andrew Haas, one Author (M. A.) has been using the Haas technique since the beginning of his orthodontic practice. As experience grew, several recurring problems were seen.

The first problem was that on older patients (females past 16 years of age and males past 18) there was difficulty in achieving true expansion in spite of following all of Haas's suggestions from the literature. Tissue impingement really became a problem, even with a change to heavier wire in appliance construction, limiting the tissue contact, and of course rounding and polishing the acrylic. Several cases showed what Haas had found — severe tissue irritation under the acrylic. In three female adults, actual palatal soft tissue aseptic necrosis required premature removal of the appliance.

On the other hand, it was readily apparent that the same palatal recontouring was not achieved with an all toothborne appliance.

A second problem occurred in unilateral maxillary width deficiency patients, who always seemed to expand on the normal side and not expand on the deficient (crossbite) side.

This problem became most apparent in treating an adult patient with severe maxillary width deficiency. Mandibular molars were missing on his slightly deficient right side, with a full complement of mandibular teeth on the left side where the crossbite existed. Examining the occlusion revealed that every time the patient closed, the left mandibular molars forced the entire maxillary arch toward the right.

A mandibular bite plane was placed, contacting the maxillary teeth in such a manner that the lingual slopes of the upper cusps were pushed to the left on closure. In a short time, the maxilla began to expand on the left and the entire maxilla appeared to move toward the left side in relation to the lower midline.

This worked so well that it seemed reasonable that all rapid palatal expansion appliances should have bite planes. Patients with bilateral crossbites or mandibular alveolar width deficiency can be treated with simultaneous fixed mandibular orthodontic expansion, which can operate unencumbered by maxillary constrictive forces.

Technique for Construction of the Rapid Palatal Expansion Bite Plane Appliance

Plain molar bands are fitted loosely to the maxillary first molars and first bicuspids. In some cases, second molars and cuspid are also banded.

Green stick compound is attached to the bands connecting the molars and bicuspids, and an overlay alginate impression made. The bands are luted to the compound with sticky wax, and a stone cast poured with the bands in place. A Hyrax appliance is then soldered to the bands on the cast, with lingual wire extensions to the second molars and cuspids (Figs. 2 and 3).

This assemblage is then replaced in the patient's mouth for sectional compound impressions from second molar to cuspid. These are poured in stone for fabrication of the acrylic bite planes (Figs 4-6). The acrylic bite planes are constructed and adjusted for flat-plane occlusal contact with the mandibular teeth, unless unilateral effects are desired.

The appliance is cemented in place, and the screw is immediately opened two quarter-turns. The patient then turns the screw once each day (Fig. 7). After the desired overcorrection is accomplished, the appliance is kept in place for four more months.

Theory Behind the Appliance

The bite plane component of the appliance has the following effects:

- Eliminates the often powerful horizontal effects of the interocclusal forces, freeing up the maxilla to expand in response to the expansion component of the appliance.
- A flat bite plane on both the right and left sides allows normal bilateral expansion. Where directional or unilateral expansion is required, the acrylic on the normal side may be designed to retain the effects of occlusal interdigitation and the deficient side freed of any occlusal contact.
- Many patients previously thought to require adjunctive surgery can be treated nonsurgically, males to at least age 25 and females to age 20.
- Hyperdivergent, vertically growing patients with short posterior face height and the palatal plane tipped down in back are aided by the vertical control of the bite plane during rapid maxillary expansion, especially where thick or active bite planes are used.
- Contouring the contact of the bite plane with the mandibular arch can enhance control of maxillary anteroposterior movement.
- Class III hooks can be added in the bicuspid region for enhancement of maxillary protraction with a football helmet with faceguard bars and protraction hooks.

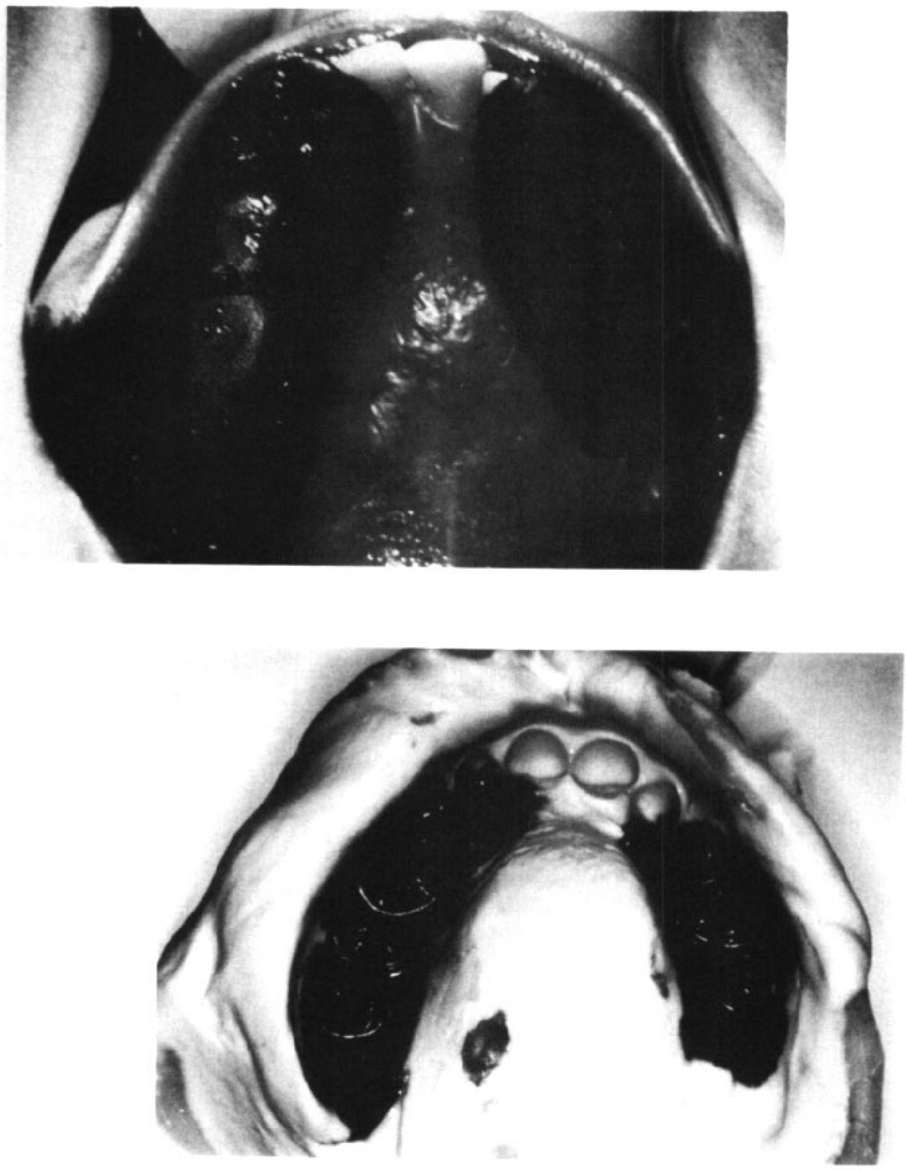

Fig. 2 Appliance construction, showing oversize bands on bicuspids and molars covered with green stick compound in preparation for an alginate impression, and the impression with the appliance in place.

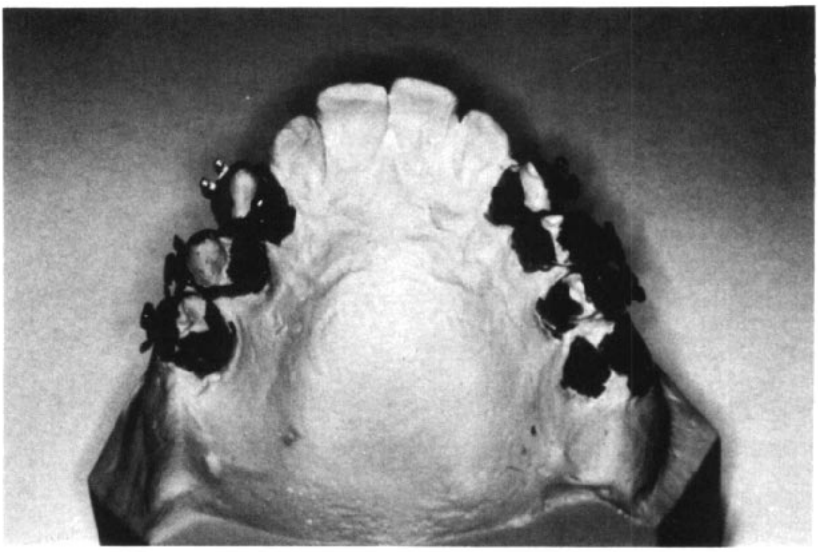

Fig. 3 Occlusal view of the appliance on the stone cast. Before pouring this cast, the sticky wax seen in this picture was luted onto the bands and compound in the impression to create a space for better heat control in soldering.

While it has not been possible to demonstrate the following effects in clinical practice, there is reason to expect the following benefits as well:

- The reduction of occlusal resistance and traumatic occlusal interference appear to enhance stability of the expansion.
- Root resorption may be reduced by the reduction of occlusal interference and trauma.
- Most adult patients with maxillary width deficiency also have some degree of TMJ dysfunction or pain. Since this procedure requires almost a month of activation followed by 4 months of retention, this is really about 5 months of full-time splint therapy. This can be enough vertical unloading of the joint to allow healing in many traumatized joints.

One disadvantage is the difficulty of adding the acrylic pads to the palatal area as advocated by Haas. The combination of the acrylic for bite plane and for palatal contact tends to create an appliance that is bulky and almost uncleanable. Further refinement of this aspect is still needed.

Removal is made more difficult by the addition of the occlusal bite planes, but it presents no serious problems. The acrylic is grooved with a bur, and then split off before removing the bands (Fig. 8).

Surgical Philosophy and Technique

The surgical technique for rapid palatal expansion with this approach is a relatively straight-forward procedure. Nevertheless, hospitalization is recommended

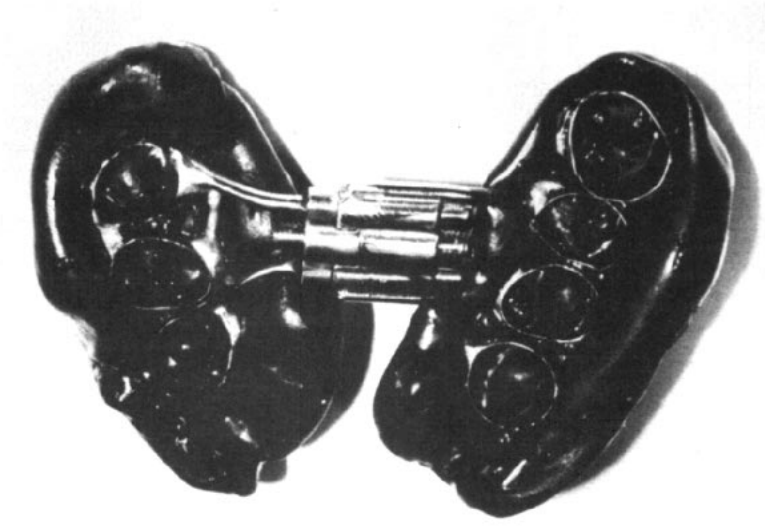

Fig. 4 Assembled metal framework and bands reseated in the mouth with green stick compound overlay impressions from molar to cuspid. These provide the occlusal detail for the addition of acrylic.

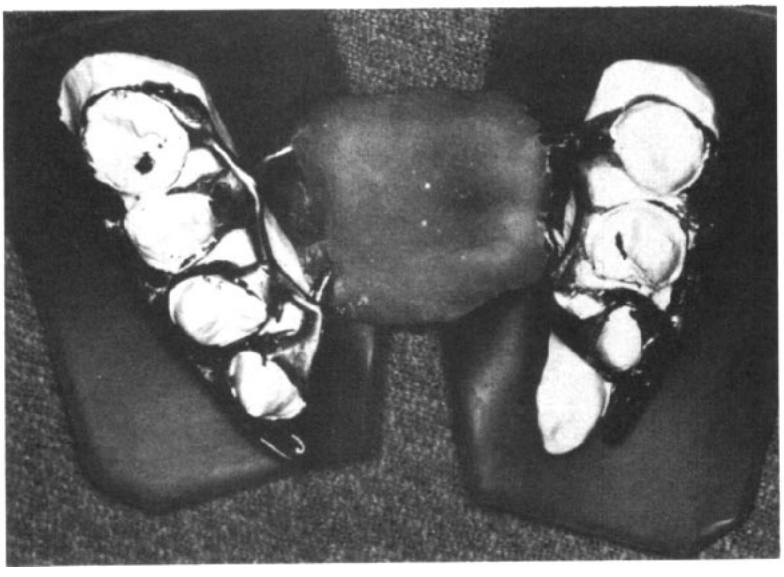

Fig. 5 Occlusal view of the second stone cast, with the expansion screw waxed and ready for the addition of the acrylic bite planes.

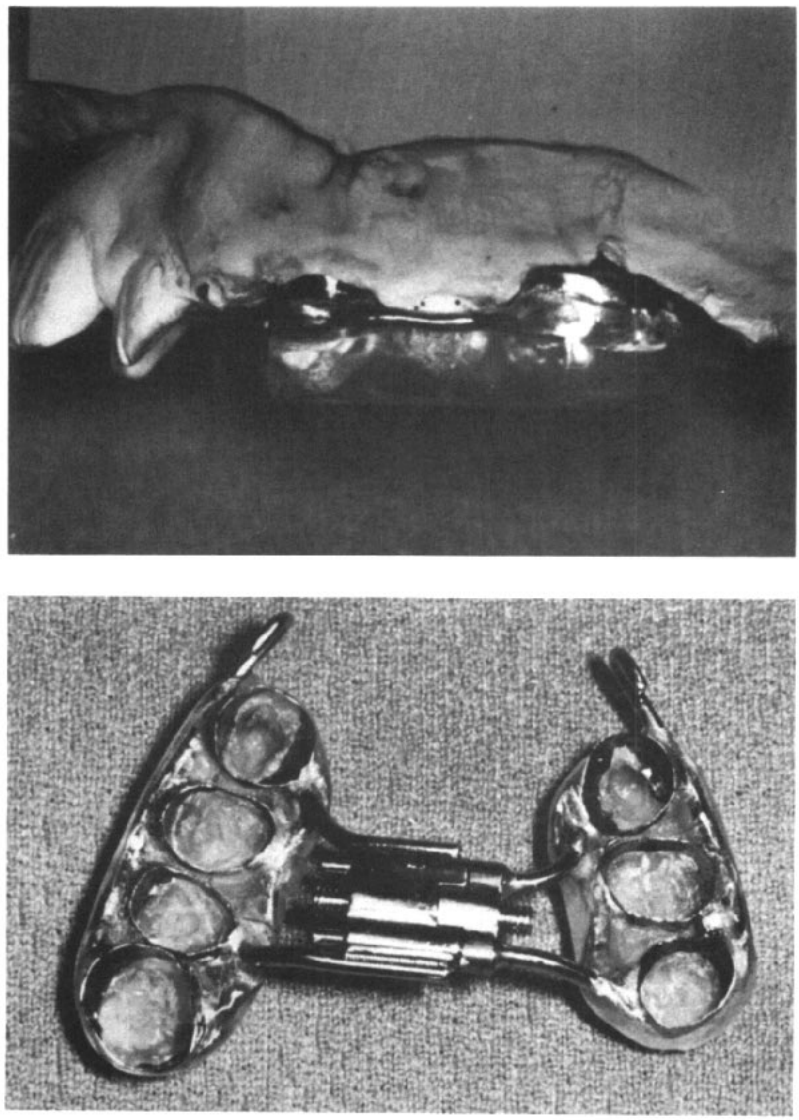

Fig. 6 Side and superior views of the completed expansion appliance with bite planes.

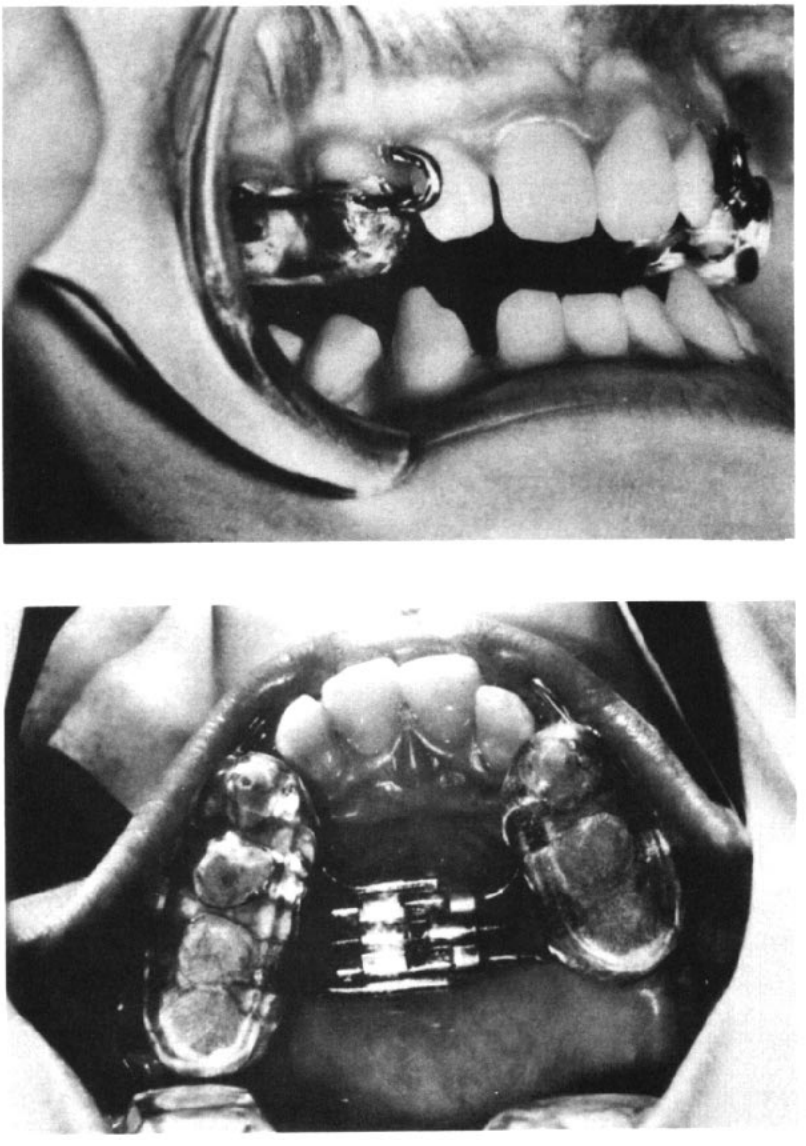

Fig. 7 Lateral and occlusal views of the appliance cemented in place. Note the hooks for attachment of anterior traction elastics.

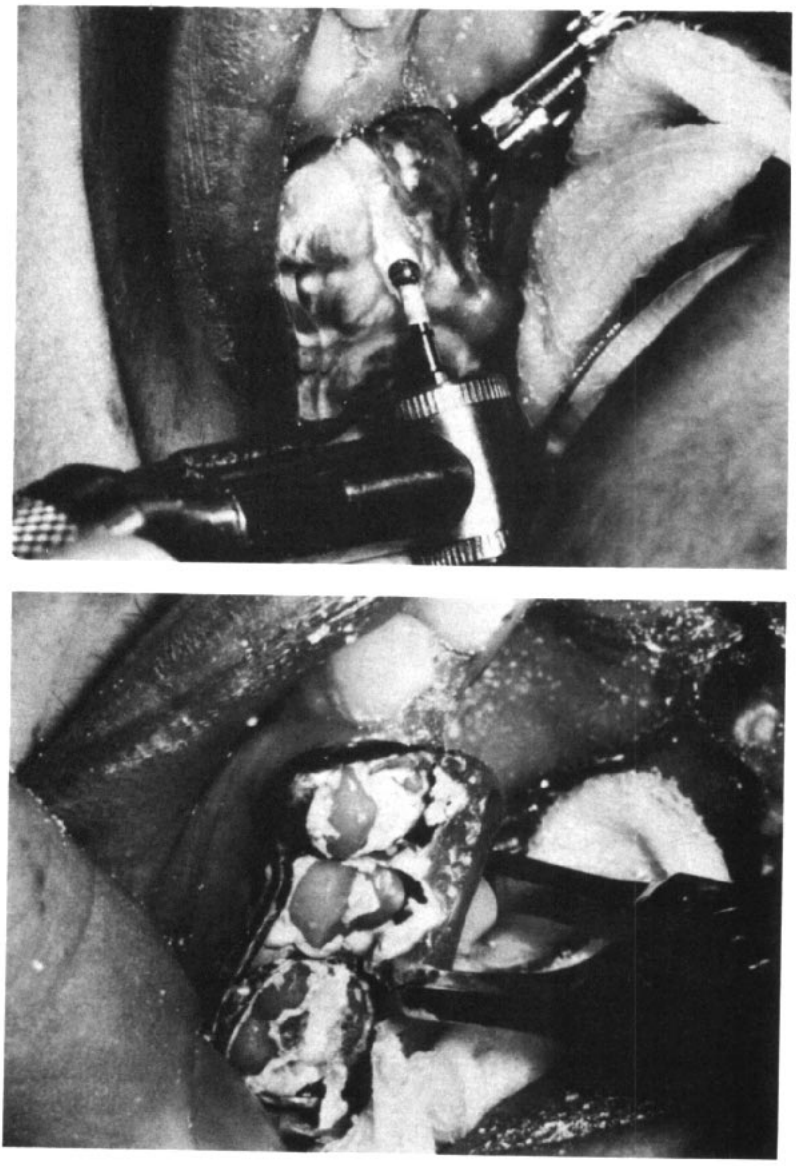

Fig. 8 Appliance removal, using an occlusal groove cut with a round bur to aid in splitting the acrylic away from the metal framework.

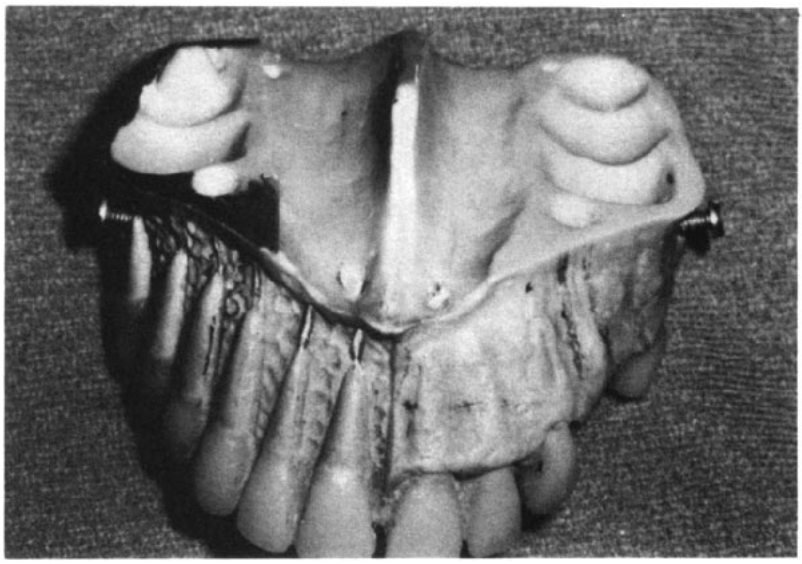

Fig. 9 Model of a horizontal section through the maxilla at the level of the osteotomy, with the osteotomy cut marked on one side. Note that midline structures are untouched in the surgical procedure.

for the sterile operating environment and airway control. Nasotracheal intubation is desirable.

The palatal expansion appliance is cemented in place by the orthodontist prior to admission for surgery. It is not activated at the time of cementation.

After infiltration of the mucosa with local anesthetic, the incision is made with an electrocautery at the depth of the buccal vestibule from the second molar area to the lateral incisor area. A mucoperiosteal flap is elevated superiorly and slightly inferiorly. The soft tissues are elevated from the facial aspect of the maxilla between the piriform rim and the pterygomaxillary fissure. At the piriform rim, the nasal mucosa is also elevated, taking care to avoid perforation, to about 3cm intranasally. The soft tissues are elevated proximally until the pterygoid fissure is easily identified and can be easily entered with a curved periosteal elevator.

Utilizing a No. 702 fissure bur, a horizontal osteotomy is made well above the apices of the teeth, parallel to the occlusal plane and extending from the piriform aperture to the pterygoid fissure. This osteotomy is carried intranasally along the lateral nasal wall. In the area of the pterygomaxillary fissure, small curved osteotomes are used to effect separation of the pterygoid plates (Fig. 9).

The identical dissection, soft tissue and osseous, is accomplished on the opposite side in bilateral cases.

At this point, the previously cemented rapid palatal expansion appliance is activated with approximately 6 to 8 quarter-turns. Blanching of the palatal mucosa is usually observed. The surgical sites are then inspected, copiously irrigated, suc-

tioned free of debris and closure effected with No. 000 Chromic gut utilizing a running interlocking technique. The mouth is irrigated, suctioned free of debris, the pharyngeal pack removed, the pharynx visualized and the anesthesia terminated.

No midline, palatal suture, medial nasal wall, or nasal septum surgery have been required. Patients tolerate the procedure well, with a minimum of blood loss or surgical risk. Postoperative edema is moderate and pain in minimal.

Since RPE-BP surgery is performed on an outpatient basis, concurrent TMJ arthroscopic surgery can be performed where appropriate. This minimizes anesthetic risk and hospital costs.

Initial study of Nonsurgical Patients

This study was based on clinical examination. True bodily movement of the basal bone appeared to occur. A large diastema appeared between the central incisors, and the patient's face appeared to widen. Nasal respiration improved dramatically. Palpation of the labial and buccal alveolar plate did not reveal any apparent root perforations. Activation of the appliance seemed to cause little patient discomfort compared to previous appliance therapy.

The reason the results were not confirmed radiographically was due to the clinician's concern for eliminating unnecessary radiation and the questionable value of x-ray verification (ALPERN 1984). X-ray verification of the clinician's judgment, even if successful, offers no patient benefit and therefore violates currently accepted rules of radiation hygiene.

— Results —

Eighty-two patients under the age of 25 have been successfully expanded using the rapid palatal expansion bite plane appliance without any surgical procedure. Twenty-five have been expanded using the same type of appliance, augmented by the corticotomy procedure described above.

In every case, successful expansion was accomplished (Fig.10). In one case, the appliance had to be removed during the 4-month retentive phase because of the patient's extremely poor oral hygiene, and it was necessary to discontinue subsequent orthodontic treatment because of lack of cooperation.

Of the 25 surgical patients operated, the average age was 30. Seven were males, ages 20 to 31. The remaining 18 were females, ranging in age from 23 to 43.

Of the 82 nonsurgical patients, 12 were females above the age of 15, with an average age of 16.5. The oldest female in the nonsurgical group was 20 years old. The oldest male to be expanded without surgery thus far was 25 years old.

The only problem encountered with nonsurgical expansion has been the one case aborted because of poor oral hygiene. All others experienced normal expansion with minimal discomfort (no more, and often less discomfort than that experienced by non-bite-plane RPE growing patients). Older patients were told that they might require an adjunctive surgical procedure, although none did.

All 25 surgical patients were planned as short (40-60 minutes) hospital outpatient procedures. All except two were completed without any problems. Two females with histories of bleeding problems (not confirmed by multiple preoperative hospital tests) required one additional day in the hospital.

One experienced nasal bleeding from the endotracheal intubation, not from the orthognathic procedure or the expansion. She was maintained in the hospital until nasal bleeding stopped, and the normal opening of the palatal appliance was

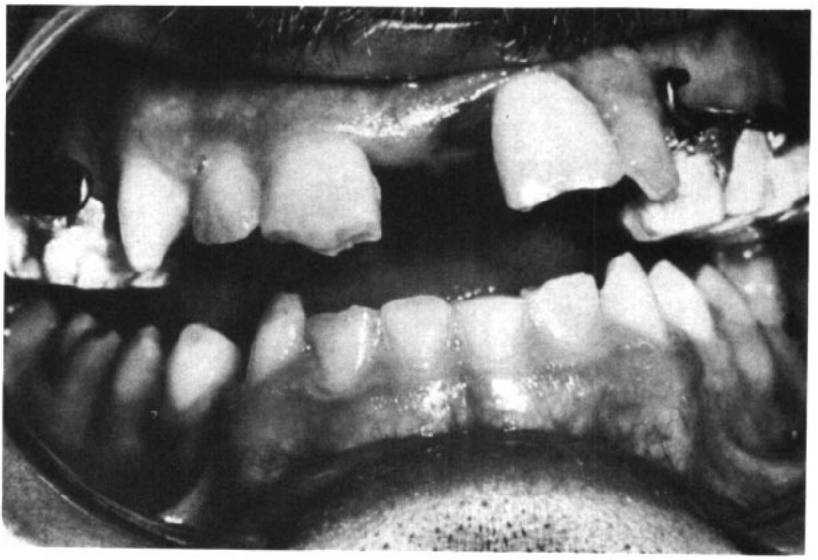

Fig. 10 Anterior view of an adult male after approximately 5 weeks of daily activation of the expansion screw following the surgical procedure. All of the diastema was produced by the expansion appliance.

applied in combination with maxillary protraction without complication or sequelae.

The other experienced bleeding from the right maxillary sinus while still under the anesthetic undergoing a TMJ arthroscopic procedure. The arthroscopic surgery was terminated so that the sinus could be explored via a Caldwell-Luc approach, and an arteriole ligated. Sutures were placed, and the patient observed overnight. Follow-up treatment proceeded uneventfully.

Five surgical patients were treated with concurrent maxillary protraction appliances. Because this surgery involves the bone around point A, it is difficult to directly assess forward movement of the maxilla. However, in each case there was a forward movement of the maxillary molars and incisors, which indicated approximately 2-3mm of forward movement of the maxilla. Subsequent retention records of these patients could verify this clinical impression.

Six of the nonsurgical patients also had maxillary protraction therapy (Fig. 7). This was started on the first day of turning the expansion screw, as in the surgical patients. It was continued 14 hours per day with approximately 16oz of force through the active expansion and 4 months of stabilization. All of these patients exhibited protraction of the maxillary teeth and, apparently, of the maxilla. The orthodontic phase of their treatment is not yet complete.

Cephalometric radiographs of one patient just before retention reveal that the maxilla appears to have moved for-

ward at point A, ANS, and at Prosthion. The maxillary incisor moved forward bodily, as did the maxillary molar. Curiously, the mandible appeared to rotate down and back. The mandibular incisor moved bodily posteriorly, and the mandibular molars uprighted. The soft tissue changes included forward movement of the tip of the upper lip, and the lower lip and chin moved backward.

The clockwise rotation of the mandible with bite opening casts doubt on the validity of the hypothesis that the maxillary bite planes hold vertical descent of the maxilla during RPE. However, some vertical restraint may still be active because this patient wore his facial mask with a pound or more of force in a mostly forward direction for more than 12 months. The facial mask, like cervical traction, could have caused some maxillary descent and bite opening.

All patients exhibited dental correction of the Class III relation with crossbite to Class I without any detectable perforation of the roots through the labial cortical plate of the premaxillary area.

Patients who had previously complained of TMJ pain or clicking or dysfunction reported improvement during or after therapy.

— Discussion —

This initial study raises many questions. At no time was any surgical procedure performed on the midpalatal suture. Yet, in spite of the fact that all patients had apparently completed their growth, every one exhibited effective expansion at the maxillary palatal suture.

As noted earlier, radiographic verification of suture opening was not attempted. Suture opening was confirmed clinically by a normal diastema that widened during expansion and closed exactly like RPE in growing patients. Also, there was no palpable root prominence suggesting perforation of the alveolar plate by buccal segment teeth, and for the most part, the expansion was stable.

A further question is, can this procedure be performed on older adults? This surgical sample size is admittedly small because it has been limited to those patients seeking treatment whose diagnosis indicated that this would be the most beneficial course. It is expected that the numbers will be expanded in the future; meanwhile, there is certainly no indication that this technique should not be appropriate for older patients.

Should this procedure be attempted on an older adult with no effective expansion within 2 days, then a midpalatal cut could easily be done in the office. The impression at this time is that this will not be required. None of the surgical patients has experienced the level of pain experienced by nonsurgical patients without a bite-plane appliance. Once expansion begins, there does not appear to be any hindrance to palatal widening.

Another question that should be addressed in the future is the amount of vertical restraint provided by bite planes and the amount of intrusion on "freeway space" that can be tolerated.

One final point. One of the rapid palatal expansion bite plane surgical patients was 20 years old. This patient might have been considered for nonsurgical expansion; however, he was a large man and attempted expansion at a university orthodontic clinic at age 13 was unsuccessful. He was attending college many hours away, time was short, and he was afraid of a repetition of the pain experienced in the previous attempt. He requested a surgical approach and we concurred.

— Conclusion —

From this initial study, it appears that a rapid palatal expansion bite-plane appliance offers the orthodontist the ability to effectively treat adults with maxillary width deficiency. Females up to 18 and males to age 21 were treated without an adjunctive surgical procedure. Adults 22 to 43 were treated with a conservative outpatient surgical osteotomy procedure that minimizes surgical risk, trauma and cost.

While the appliance does not have acrylic palatal contact to assist in recontouring the palate, it does effectively permit maxillary expansion and protraction. It is also possible that bite planes may lessen root resorption and TMJ microtrauma by removing interfering heavy biting forces which resist expansion, as well as reduce the previously described vertical effect of RPE in hyperdivergent patients.

Several questions remain to be answered, and future study will undoubtedly produce questions as well as answers. AJO

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